NSW HEALTH

Selected Specialty and Statewide Service Plans

Number Seven

Radiotherapy Services in NSW Strategic Plan to 2016

NSW GOVERNMENT

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Further copies of this document can be downloaded from the NSW Health website www.health.nsw.gov.au

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Abbreviations

ACPSEM	Australasian College of Physical Scientists and Engineers in Medicine
AHMAC	Australian Health Ministers' Advisory Council
AIR	Australian Institute of Radiography
BPI	Business Process Improvement
BTE	Basic Treatment Equivalent
CCAHS	Central Coast Area Health Service
CCORE	Collaboration for Cancer Outcomes Research and Evaluation
CI NSW	Cancer Institute NSW
CSAHS	Central Sydney Area Health Service
CTEPC	Clinical, Technical and Ethical Principal Committee
ESTRO	European Society for Therapeutic Radiology and Radiation Oncology
FTE	Full Time Equivalent
FWAHS	Far West Area Health Service
GP	General Practitioner
GMAHS	Greater Murray Area Health Service
HAHS	Hunter Area Health Service
HealthPACT	Health Policy Advisory Committee for Technology
HPG	Health Program Grant
HTA	Health Technology Assessment
HWA	Health Workforce Australia
IAHS	Illawarra Area Health Service
IGRT	Imaged Guided Radiotherapy
IMET	NSW Institute of Medical Education and Training
IMRT	Intensity Modulated Radiotherapy
IPTAAS	Isolated Patients Travel and Accommodation Assistance Scheme
Linac	Linear accelerator
MAHS	Macquarie Area Health Service
MNCAHS	Mid North Coast Area Health Service
MRT	Master of Radiation Therapy
MSAC	Medical Services Advisory Committee
MWAHS	Mid Western Area Health Service
NCCI	North Coast Cancer Institute
NEAHS	New England Area Health Service
NFC	Nationally Funded Centre
NRAHS	Northern Rivers Area Health Service
NSAHS	Northern Sydney Area Health Service

Abbreviations

OSMR	NSW Office for Science and Medical Research
PDY	Professional Development Year
RANZCR	The Royal Australian and New Zealand College of Radiologists
RCC	Regional Cancer Centre
RJAC	Radiotherapy Joint Advisory Committee
RMIS	Radiotherapy Management Information System
ROJIG	Radiation Oncology Jurisdictional Implementation Group
ROMP	Radiation Oncology Medical Physicist
RORIC	Radiation Oncology Reform Implementation Committee
ROTC	Radiation Oncology Treatment Centre
ROVR	Radiation Oncology Vocational Registrar
S&SS	Statewide and Selected Specialty
SAHS	Southern Area Health Service
SESAHS	South Eastern Sydney Area Health Service
SMU	Single Machine Unit
SPP	Service Procurement Plan
SRS	Stereotactic Radiosurgery
SWSAHS	South Western Sydney Area Health Service
TEAP	Training, Education and Accreditation Program
TROG	Trans Tasman Radiation Oncology Group Limited
WAHS	Wentworth Area Health Service
WSAHS	Western Sydney Area Health Service

Executive summary

The current lifetime risk of being diagnosed with cancer in NSW is one in two for men, and one in three for women. It is the largest single cause of disease in Australia. Treatments available for cancer include surgery, chemotherapy, and radiotherapy, as well as other hormonal and targeted therapies.

Radiotherapy is one of the main treatments for cancer, and is both a clinically and technically complex treatment. Radiotherapy uses ionising radiation to destroy or damage cancer cells so they cannot multiply.

The Radiotherapy Services Strategic Plan to 2016 provides direction for the continued, improved access to radiotherapy services in NSW, and identifies the geographic areas for new and expanded radiotherapy services in NSW, as resources become available. The Plan has a number of dimensions, including consideration of equipment replacement and workforce planning. It is important to note that service planning and development is an ongoing process. It is informed by the robust data and methodologies described.

Appropriate review of planning guidelines and parameters, supported at a national level, will guide the implementation of this Plan. Changes to these parameters will be monitored and their implications considered accordingly.

NSW follows the nationally supported planning approach that radiotherapy services are best delivered through an integrated and multidisciplinary model, with clear linkages to a number of subspecialty disciplines, such as medical oncology, paediatric oncology, surgical oncology, clinical haematology, palliative care and rehabilitation, as part of a quality comprehensive cancer service.

Radiotherapy services need to have an appropriate level of clinical support services, such as diagnostic imaging, nuclear medicine, pathology, intensive care unit and pharmacy services to support the delivery of quality services, and the skilled workforce necessary to provide a quality sustainable service. On-site or networked services in supportive care, psychosocial assistance and pharmacy services are also required. This comprehensive service model is provided by a range of health professionals including medical, technical, nursing and allied health professionals.

As a result of all these inter-related service issues, the location of radiotherapy services follows a comprehensive service development process which considers these, and other population demand factors, in that process.

Radiotherapy is part of a service continuum, its effective planning and delivery requires the inclusion of primary care providers. Therefore, recognition of the role of General Practitioners, community-based services and other non-institutional-based care is essential.

In NSW, radiotherapy treatment for the majority of paediatric patients is to be undertaken at selected sites, that is, by those centres which are co-located with specialist Children's Hospitals, or which can demonstrate closely networking and have formalised arrangements in place.

NSW Health has taken a strategic approach to planning for the growth in the physical infrastructure needed to support radiotherapy treatment services. Implementation of three successive five-year strategic plans for radiotherapy has positioned the health system well, to respond to the growing demand for these services through the expansion of services across NSW.

The NSW Government has made significant investment in both infrastructure to establish and expand services, and the ongoing funding required to support the effective operation of these services. Since 1995, NSW has invested over $150 million to expand the capacity of services to treat cancer through new and replacement linear accelerators. This has occurred through the expansion of services at Calvary Mater Hospital, Newcastle, and the establishment of the North Coast Cancer Institute at Coffs Harbour and Port Macquarie. Over $45 million additional funding has been committed to establish new services at Lismore

and Orange. More recently, the Commonwealth Government has also made some contribution to capital costs of services.

In addition to the capital investment made, since 2003/04 funding of over $13 million has been allocated to operate the additional treatment services at existing and new centres. The outcomes of this investment have been increased treatment capacity and increased geographical access to services.

Radiotherapy service expansions in the public sector currently underway include: the Central West Radiation Oncology Service (as part of the redevelopment of the Orange Base and Bloomfield Hospitals); the Integrated Cancer Care Centre at Lismore Base Hospital; and, expansion of the Liverpool Cancer Therapy Centre at Liverpool Hospital. Over the past five years, there has been increased interest by the private sector in establishing additional services. Six linear accelerators in the private sector have received Commonwealth approval for receipt of Health Program Grants.

As part of its planning process, NSW identified the following geographic areas of need for future new services and expansion of existing services: the Central Coast; western Sydney; the Illawarra and Shoalhaven region; and Hunter New England.

The NSW Government successfully applied for funding under the Commonwealth Government's Health and Hospitals Fund Regional Cancer Centres initiative. In April 2010, the Commonwealth Government announced funding towards the establishment of new regional cancer centres at Tamworth, Nowra and Gosford, The Northern Rivers Cancer Community Foundation were also successful in an application for patient and carer accommodation at the Lismore centre. As part of this initiative, radiotherapy treatment services will also be expanded at existing cancer centres at Wollongong, Port Macquarie and Lismore. Western Sydney and the Hunter remain areas of need.

As indicated, the primary objective of service planning and development for NSW radiotherapy services has been to increase access. When the new services at Lismore, Orange, Nowra and Tamworth commence operation, more than 95% of NSW residents will be within 100 kilometres of a radiation oncology treatment centre. This is a significant achievement, but does highlight the need to also provide access strategies for those parts of the state that will not be able to sustain locally provided services.

There are a number of roles and responsibilities, relating to cancer care across the NSW Department of Health; Area Health Services; the Cancer Institute NSW, as well as at the Commonwealth Government level.

The NSW Department of Health is responsible for ensuring that the people of NSW are provided with the best possible health care within available resources. The Department monitors the performance of the NSW public health system and supports the statutory role of the NSW Minister for Health. It develops and promulgates policy directives and planning frameworks for the development and delivery of cancer services. The Department is responsible for planning statewide and selected specialty services such as radiotherapy.

Executive Summary

The Cancer Institute NSW is charged with substantially improving cancer control in NSW. It has released the NSW Cancer Plans 2004 - 2006 and 2007-2010, which focus on cancer prevention and detection and improving cancer services. The objectives of the Cancer Institute NSW are to increase the survival rate for cancer patients; reduce the incidence of cancer in the community; improve the quality of life of cancer patients and their carers; and, to operate as a source of expertise on cancer control for the government, health service providers, medical researchers and the general community.

Area Health Services are responsible for the planning and delivery of public health services, and for responsibly utilising funds to deliver a wide range of services within NSW, including radiotherapy.

Following consideration of the need to review a number of inputs to radiotherapy service planning by the Radiation Oncology Reform Implementation Committee, the Commonwealth Government has indicated that financial support may be given to a review of the optimal proportion of new cancers that would benefit from radiotherapy. An appropriate expert group will be confirmed following the Commonwealth Government tender process. This review poses a number of important challenges in reviewing planning targets to ensure that they reflect contemporary practice and consideration of the various treatment options available in NSW for people with cancer. It is understood that the process to engage a consultant to conduct the review will commence in 2010.

The NSW Department of Health appreciates and acknowledges the contribution and advice from a number of individual experts including medical physicists; chief radiation therapists; directors of radiation oncology; paediatricians; Area Health Service planning experts; as well as members of the Radiotherapy Joint Advisory Committee and other groups consulted in the development of this Plan. The drafting of this Plan also involved private radiotherapy services and peak NSW cancer groups for their consideration and comment.

Introduction

1

Cancer is a disease that touches a large proportion of the community in NSW. Cancer comprises of over 100 different tumour sites with a wide variability in scientific knowledge about different cancers; their causes; and optimal treatment.[1] The current lifetime risk of being diagnosed with cancer in NSW is one in two for men, and one in three for women. Cancer is the largest single cause of disease in Australia and the risk of cancer increases as the population ages. Based on the current trends, there is projected to be over 30% more cases of cancer over the next ten years than there were in the last ten years. [2] The number of cancer cases continues to grow as a result of population growth, as well as the ageing population.

The primary objective for cancer control is the provision of optimal cancer management, which integrates cancer services and programs, incorporating evidence-based practice. [3] Cancer patient survival in NSW is among the best in Australia, and internationally. NSW's overall five-year survival rate for cancer is 63%. This is similar to Queensland and slightly better than Victoria, for all cancers and for selected major cancers. As an international comparison, the five year survival for all cancers combined was 65% in the United States.[4]

The spectrum of health services required to best manage cancer needs to be planned to maximise patient outcomes, within available resources. In cancer control, the health continuum includes prevention, promotion, screening, early detection and diagnosis, treatment, palliation or recovery, and psychosocial and supportive care. Screening allows early detection of cancer in people without any symptoms; diagnosis includes consultation, medical imaging, x-rays, scans, laboratory tests and tissue sampling. Multidisciplinary care services including subspecialty surgical oncology, medical oncology, haematological oncology, radiation oncology, psycho-oncology and research, should be an integral component of comprehensive cancer care services.[5]

There are a number of treatments available for cancer, including surgery, chemotherapy and radiotherapy. There continues to be development of other treatment options including hormonal therapy, targeted therapy, cryotherapy, pain management drugs and high intensity focussed ultrasound. In the past five years, there has been enormous progress in drug treatment for patients with most forms of cancer, paralleled by dramatic reductions in cancer mortality. New "smart drugs" target specific abnormalities in the 'software' of cancer cells and offer great hope for controlling the disease.

The types of treatment selected for patients with cancer will depend on a number of factors including the type of cancer; location and grade of the tumour and spread of the cancer; individual patient health, age; and personal choice and assessment of side effects.

Within this context of alternative and complementary cancer care, radiotherapy is one of the main treatments for cancer, and is both a clinically and technically complex treatment. It is used as part of an overall treatment plan generally in conjunction with surgery and chemotherapy. Radiotherapy uses ionising radiation to destroy or damage cancer cells so they cannot multiply. Radiotherapy treatment in NSW is predominantly used for curative purposes, but is also used palliatively to control, or relieve, symptoms.

Radiotherapy may be delivered externally, using a machine called a linear accelerator (or for some cancers a superficial / orthovoltage machine), or internally (also known as brachytherapy) which involves the placement of implanted radioactive materials inside the body, in, or near, the cancer. The delivery of radiotherapy is very precise in order to limit harm to surrounding healthy tissues. For this reason, radiotherapy is given in many fractions over a course of treatment, allowing healthy tissue to recover between

1 Radiation Oncology Jurisdictional Implementation Group (ROJIG) Final Report, 2003
2 Cancer Institute NSW. NSW Cancer Plan 2007 – 2010. Cancer Institute NSW, Sydney 2006.
3 ROJIG Final Report, 2003. p. 5
4 Tracey E, Barraclough H, Chen W, Baker D, Roder D, Jelfs P, Bishop J. Survival from Cancer in NSW: 1980 to 2003. Sydney, Cancer Institute NSW, August 2007. p. 13.
5 ROJIG Final Report, 2003, p. 5

fractions. The treatment course may last up to five to eight weeks, and be given five days a week over that period.

Other factors influencing treatment include: individual patient choice; range of therapies available; patient referral pathways (from screening to treatment initiation and from General Practitioner (GP) to appropriate specialist); costs; availability of accommodation and transport; and availability of a carer or support network to assist the patient in receiving radiotherapy treatment.

NSW follows the nationally supported planning approach that radiotherapy services are best delivered through an integrated and multidisciplinary model, with clear linkages to a number of subspecialty disciplines, such as medical oncology, paediatric oncology, surgical oncology, clinical haematology, palliative care and rehabilitation, as part of a quality comprehensive cancer service.

Radiotherapy services need to have an appropriate level of clinical support services, such as diagnostic imaging, nuclear medicine, pathology, intensive care unit and pharmacy services to support the delivery of quality services, and the skilled workforce necessary to provide a quality sustainable service. On-site or networked services in supportive care, psychosocial assistance and pharmacy services are also required. This comprehensive service model is provided by a range of health professionals including medical, technical, nursing and allied health professionals.

As a result of all these inter-related service issues, the location of radiotherapy services follows a comprehensive service development process which considers these, and other population demand factors, in that process.

Radiotherapy is part of a service continuum, its effective planning and delivery requires the inclusion of primary care providers. Therefore, recognition of the role of General Practitioners, community-based services and other non-institutional-based care is essential.

The NSW policy is that radiotherapy treatment for the majority of paediatric patients to be undertaken at selected sites, that is, by those centres which are co-located with specialist Children's Hospitals. The treatment of children with radiotherapy poses special challenges for the radiation therapy team, as the numbers of child patients are small and their needs are often quite different to an adult patient, hence, the benefits of established clinical relationships during this period of care.

To obtain optimal cancer results, cancer treatment requires a multidisciplinary approach in most cases. In a multidisciplinary approach to care, the treatment options for patients are considered by a team, including medical specialists, nurses and allied health professionals from the various oncology sub-specialities with relevant expertise.

The approach taken by NSW is that radiotherapy services are to be integrated with a number of subspecialty disciplines as part of a quality comprehensive cancer service and which facilitates the use of multidisciplinary teams in the treatment of cancer.

1.1 Background

The NSW Government through the Department of Health is responsible for promoting good health care, based upon the principles described in the NSW State Health Plan. There are a number of roles and responsibilities in cancer care across the Department, Area Health Services and Cancer Institute NSW (CI NSW).

The CI NSW was established in July 2003 through the *Cancer Institute NSW Act 2003*. It is funded by the NSW State Government. It is a statutory body governed by the Cancer Institute NSW Board.

The CI NSW provides a source of expertise on cancer and provides expert advice to patients, the public, health care professionals and the Government. The CI NSW is charged with substantially improving cancer control in NSW. This will be achieved by:

- reducing the incidence of cancer in NSW;
- increasing the survival rate for people diagnosed with cancer;
- improving the quality of life for cancer patients and their carers; and

- become a source of expertise on cancer and provide expert advice to patients, the public, health care professionals and the Government.

NSW Health provides policy directives and planning frameworks and implements decisions on a number of health related issues. NSW Health comprises the NSW Department of Health and public health organisations. The public health organisations include Area Health Services; Ambulance Service; Justice Health; The Children's Hospital at Westmead; the Clinical Excellence Commission; Health Infrastructure; and, Health Support Services.

The NSW Department of Health:

- supports the NSW Minister for Health in promoting, protecting, developing, maintaining and improving the health and wellbeing of the people of NSW;
- plans the provision of comprehensive, balanced and co-ordinated health services throughout NSW; and
- monitors the performance of the NSW public health system.

Area Health Services are responsible for the planning and delivery of public health services, as required under the *Health Services Act 1997*, and for responsibly utilising funds to deliver a range of services within NSW, including radiotherapy. Area Health Services are responsible for providing health services in a wide range of settings, from primary care posts in the remote outback to metropolitan tertiary health centres. As stated under the Health Services Act 1997, the primary purposes of an Area Health Service are to:

- provide relief to sick and injured persons through the provision of care and treatment,
- promote, protect and maintain the health of the community.

NSW Health has taken a strategic approach to planning for the growth in the physical infrastructure needed to support radiotherapy treatment services. Implementation of three five-year strategic plans for radiotherapy has better positioned the health system to respond to the growing demand for these services through the expansion of capacity across NSW. The latest phase of growth was completed in December 2007 with the commissioning of the linear accelerator at Royal Prince Alfred Hospital and the commencement of the North Coast Cancer Institute.

As at the end of June 2010, there are 46 linear accelerators operating in NSW – 37 in 14 public facilities and nine in five private facilities. In 1995, there were 29 machines - 24 linear accelerators operating in the nine public facilities, and five machines operating in three private facilities. This is an increase of over 55% in the number of linear accelerators operating in NSW since 1995.

Since 1995, NSW has invested over $150 million to expand access and increase the capacity of services to treat cancer through new and replacement linear accelerators. This has occurred through the expansion of services at Calvary Mater Hospital Newcastle; and the establishment of the North Coast Cancer Institute at Coffs Harbour and Port Macquarie. A further $45 million will be invested in establishing new services at Lismore and Orange. In addition to the capital investment made, since 2003/04, funding of over $13 million has been allocated to operate the additional treatment machines at existing and new centres.

In addition to the significant investment by the NSW Government, the Commonwealth Government has also commenced a strategy to partner with NSW Health to provide capital to facilitate this growth. More recently, there has also been increased interest by the private sector in establishing additional services in NSW.

Introduction

The Radiotherapy Services Strategic Plan to 2016 provides direction for the continued, improved access to radiotherapy services in NSW, and identifies the geographic areas for new and expanded radiotherapy services in NSW. The Plan also includes a program for replacement of linear accelerators.

Implementation of the Plan will provide expanded radiotherapy services in NSW which will:

- improve patient access to radiotherapy, leading to improved outcomes for cancer patients;
- respond to increasing demand for radiotherapy treatment; and
- ensure timely replacement of existing linear accelerators.

Radiotherapy is currently considered a statewide and selected specialty (S&SS) service by NSW Health. S&SS services are usually high cost and/or highly specialised services that are provided in limited locations, but accessed by residents across NSW or across a group of Area Health Services.

Quality, safety and sustainability are key considerations in the establishment of S&SS services. Locations of S&SS services are often limited to ensure appropriate throughput of patients and specialised focus for skills and resources. Consideration is also given to efficient service delivery and the need to ensure specialised services are not duplicated in terms of critical infrastructure, whilst reducing impediments to access by residents.

Radiotherapy services are capital intensive services, in terms of the high infrastructure costs in establishing and developing the service; specialist buildings; and, radiotherapy and diagnostic equipment. The recurrent operating costs for the specialist workforces to deliver the service are also an important consideration in assessing future services.

The development of new, and expansion of, existing services in the public sector will continue to take into account the growth in services provided by the private sector. The pace of implementation of this Plan will be dependent on the availability of resources, in the context of overall health demands.

NSW cancer and radiotherapy policy context

2

A number of strategic documents provide the foundation for the delivery of cancer services, more generally, and therefore radiotherapy in NSW:

- The *State Plan – a New Direction for NSW* [6] includes the aim of improving access to quality health care.
- The *State Health Plan – Towards 2010* [7] outlines that the growth and ageing of the NSW population is a major factor in driving up health costs, which continue to place increasing demands on health and other human services.
- *The Future Directions for Health in NSW – Towards 2025* [8] highlights the major challenges to the healthcare system, including the persistent health inequities for rural residents having a shorter average life expectancy than those living in urban areas, and shortfalls of health staff in rural and remote areas.
- The NSW Health's *Clinical Service Framework for Optimising Cancer Care in NSW (2003).* [9]
- Since inception, the CI NSW has published two Cancer Plans, *NSW Cancer Plan 2004-2006* [10] and *NSW Cancer Plan 2007-2010*. [11] Both focus on cancer prevention and detection; improving cancer services and professional education; research; and data collection and analysis. During February 2010, the CI NSW undertook public consultation for the NSW Cancer Plan 2011 – 2015.
- The *NSW Rural Health Report* [12] recommends provision of a wider range of services, where appropriate, closer to where people live.
- *Caring Together: The Health Action Plan for NSW* [13] outlines the Government response to the Garling Inquiry findings and recommendations. [14] The Government's response sets out a new direction for increasing the engagement of the community and the workforce in service delivery, and a greater focus on patient centred care.

Radiotherapy has been the subject of many reviews at national [15] and state levels [16]. The report 'A Vision for Radiotherapy – Report of the Radiation Oncology Inquiry' (known as the Baume Report) played a significant role in consolidating a position in 2002. In response to Baume, all jurisdictions worked together, through the Radiation Oncology Jurisdictional Implementation Group (ROJIG), to formulate a nationally agreed response to issues outlined in the Report. The ROJIG Report provides direction and detail for service development for radiotherapy. The Radiation Oncology Reform Implementation Committee (RORIC) continues to play a significant role in collaborative reform, service planning and workforce strategy development.

In 2009, the NSW Audit Office completed its review of radiotherapy services in NSW regarding access to services, adequacy of staffing, utilisation of resources and future adequacy. [17] The Report found that overall the system is performing well and there have been large gains in the treatment of, and survival from, many cancers in recent years. The Cancer Council also released a report on radiotherapy services in NSW in 2009, which made a number of recommendations.[18]

6 NSW Premier's Department. A New Direction for NSW – State Plan. Sydney, November 2006.
7 NSW Department of Health. A New Direction for NSW - State Health Plan Towards 2010. Sydney, February 2007.
8 NSW Department of Health. Future Directions for Health in NSW - Towards 2025. Sydney. February 2007
9 NSW Department of Health. A Clinical Service Framework for Optimising Cancer Care in NSW (2003). Sydney, May 2003
10 Cancer Institute NSW. NSW Cancer Plan 2004-2006. July 2004.
11 Cancer Institute NSW. NSW Cancer Plan 2007-2010. November 2006.
12 The NSW Rural Health Report – The Report of the Rural Health Implementation. Coordination Group NSW Government Action Plan, Sydney. 2002
13 NSW Department of Health. Caring Together - The Health Action Plan for NSW. Sydney, 2009.
14 Garling, Peter Final Report of the Special Commission of Inquiry: acute care services in NSW public hospitals. Sydney, NSW. Department of the Premier, 2008
15 A Vision for Radiotherapy – Report of the Radiation Oncology Inquiry. (Chair Peter Baume) Canberra, Department of Health and Ageing, 2002
16 In 2009, The Cancer Council issued "Improving Radiotherapy Where to From Here – A Roadmap for the NSW Government" and the NSW Audit Office released its review 'Tackling Cancer with Radiotherapy' in June 2009.
17 NSW Audit Office. Tackling Cancer with Radiotherapy – NSW Department of Health (Performance Audit). Sydney, Audit Office, June 2009.
18 Cancer Council. Improving Radiotherapy – Where to From Here: A Roadmap for the NSW Government May 2009.

3 Current distribution of radiotherapy facilities in NSW

Radiotherapy services in NSW have been provided by both the public and the private sector for many decades. Radiotherapy service planning acknowledges the services provided by the private sector. The public and private Radiation Oncology Treatment Centres (ROTCs) operating in NSW as at June 2010 are listed below. These centres are shown on Maps 1 and 2.

Public ROTCs	Private ROTCs
Illawarra Cancer Care Centre (Wollongong)	Central Coast Radiation Oncology Centre (Gosford)
Prince of Wales Hospital (Randwick)	Sydney Radiation Oncology Centre (Wahroonga)
St George Cancer Care Centre (Kogarah)	Radiation Oncology Associates Mater (Crows Nest)
St Vincent's Hospital (Darlinghurst)	Radiation Oncology Associates St Vincent's Hospital (Darlinghurst)
Liverpool Cancer Therapy Centre (Liverpool)	Riverina Cancer Care Centre (Wagga Wagga)
Macarthur Cancer Therapy Centre (Campbelltown)	
Royal Prince Alfred Hospital (Camperdown)	
Nepean Cancer Care Centre (Kingswood)	
Westmead Cancer Care Centre (Westmead)	
Royal North Shore Hospital (St Leonards)	
Calvary Mater Newcastle (Waratah, Newcastle)	
North Coast Cancer Institute (Coffs Harbour)	
North Coast Cancer Institute (Port Macquarie)	
North Coast Cancer Institute (Lismore)	

Following a period of relative stability in the number of linear accelerators in the private sector, a number of new private services have been identified as due to commence operation by 2011, with some centres indicating commencing in the second half of 2010.

The public sector remains the main provider of radiotherapy services in NSW. Over 75% of all radiotherapy courses delivered in NSW is provided in the public sector, including care for the most complex cases. As at June 2010, there are 46 linear accelerators in NSW, with 37 of these in the public facilities. Recent expansions include a second treatment machine at Coffs Harbour; a fifth machine each at the Royal Prince Alfred and Calvary Mater Newcastle hospitals, and the first machine at the Lismore site of the North Coast Cancer Institute (Appendix 1).

In 2010, there are currently some parts of the State where the local radiotherapy services are provided only by the private sector (Central Coast and south west NSW). Due to a range of issues related to population size and distributions, in some parts of the state there are no locally provided radiotherapy services. In these cases, generally outreach services enable these residents to be provided with overall cancer care and referral to radiotherapy centres for this part of treatment. These areas include New England, South Coast (Shoalhaven area) and Greater West. With improvements in technology, remote planning of radiotherapy patients is possible and is currently being undertaken at Dubbo Hospital in conjunction with Royal Prince Alfred Hospital. The Dubbo service will become part of the Central West Cancer Service.

In addition, a portion of NSW residents receive their radiotherapy treatment at interstate centres, usually because of geographic proximity but sometimes due to family / carer support. These flows are primarily to Queensland, ACT, Victoria, and South Australia.

Current distribution of radiotherapy facilities in NSW

A joint Queensland Health and NSW Health planning study for south east Queensland and the far north coast of NSW was completed in 2008. It was undertaken to identify the healthcare requirements of these residents, and to ensure an integrated approach to service delivery for the residents of these areas. The study identified that radiotherapy services for these residents had been factored into the establishment of services at the new Gold Coast Hospital, and that residents of areas such as the Tweed could access radiotherapy services at the new hospital, which is less than one hour's travel from Tweed Heads. In addition, private radiotherapy services are available at the John Flynn Hospital which is about 10 kilometres away.

Real improvements in access to services have occurred, not only through the number of additional treatment machines, but also through the increased geographic coverage of services; and, a program of replacement machines which provides access to contemporary technology in treatment.

Publicly provided services are now available in outer metropolitan and rural areas, such as Campbelltown, Penrith, Coffs Harbour and Port Macquarie. The change in patient flows and access, as a result of these service developments, are highlighted as follows.

3.1 Campbelltown

The Macarthur Cancer Therapy Centre, located at Campbelltown, is part of the current Sydney South West Area Health Service. The centre sits in the western part of the Area which includes Bankstown, Fairfield, Liverpool, Campbelltown, Camden, Wollondilly and Wingecaribee.

The estimated resident population of the western zone of the Area Health Service as at June 2007 was 819,010 [19] and is projected to increase by 17% to 958,395 by 2016. [20]

In 2008, the centre treated 28% of residents of the former South Western Sydney Area Health Service who received radiotherapy in NSW. Together with the Liverpool Cancer Therapy Centre, also in the Western Zone, these two centres treated 73% of the former Area Health Service residents who received new courses of treatment in 2008. Royal Prince Alfred Hospital treated 6.5% and Westmead Cancer Care Centre treated 8.5%. This is a significant improvement in access to care, from 2000, when all patients from this area needed to travel for care.

3.2 Penrith

The Nepean Cancer Care Centre (NCCC) commenced in 1998 with one machine and was part of the Wentworth Area Health Service. A second machine commenced in 2001. By 2008, 80% of the former Wentworth Area Health Service residents received their radiotherapy treatment at NCCC.

3.3 Coffs Harbour and Port Macquarie

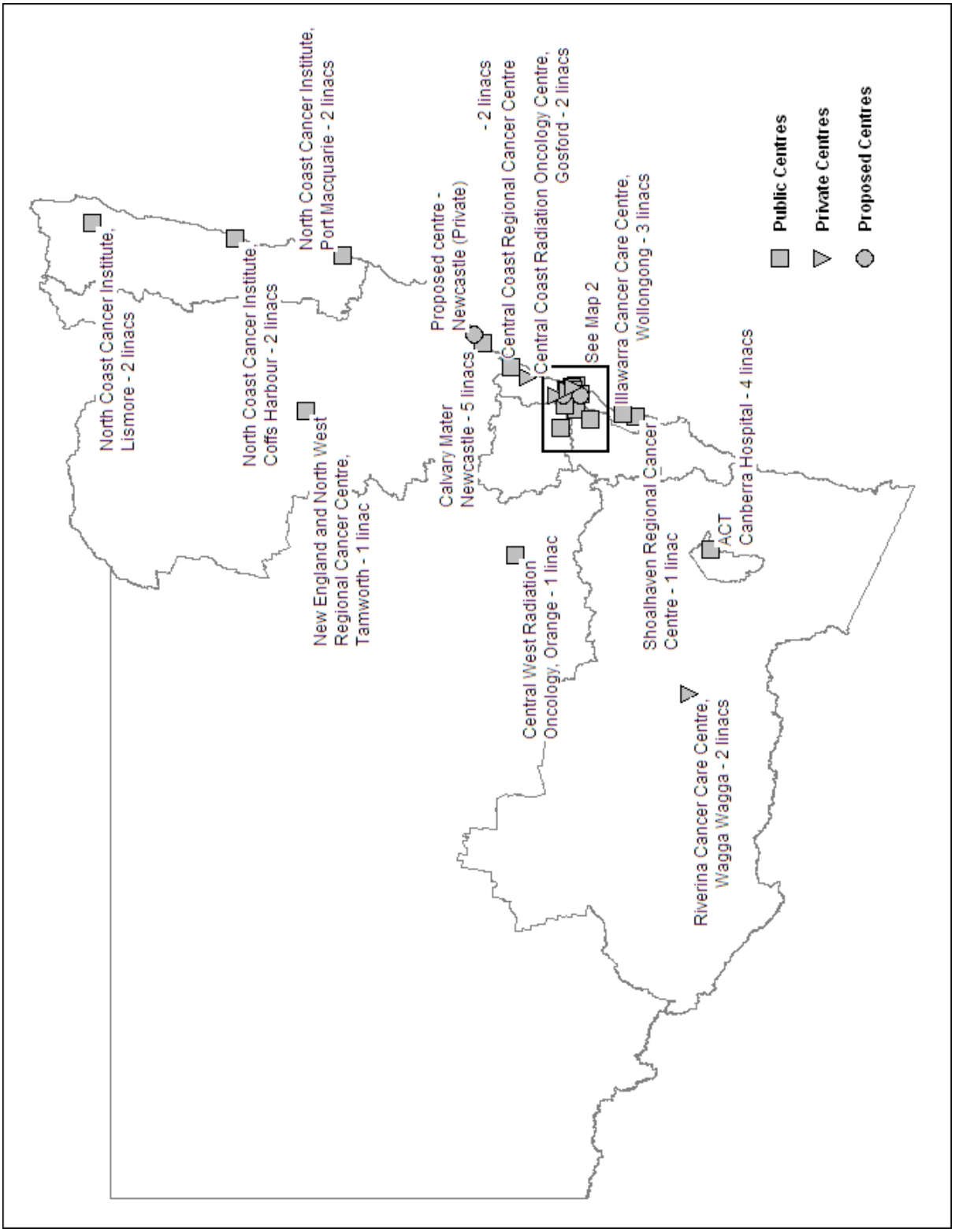
The North Coast Cancer Institute (NCCI) commenced operation in May 2007. The NCCI services were part of the former Mid North Coast Area Service (MNCAHS), adjoining the former Northern Rivers Area Health Service (NRAHS) which extends to the Queensland border. By the end of 2008, almost 70% of MNCAHS residents and almost 15% of NRAHS residents were receiving radiotherapy closer to home. This has had a very positive impact for those residents, in terms of not having to travel to a metropolitan centre for treatment.

Following amalgamation of the MNAHS and the NRAHS, the NCCI treated almost 43% of residents who had received radiotherapy in 2008. It is anticipated that after the first year, and a "settling in" period, the Lismore and Orange centres will account for over half the radiotherapy treatments delivered to their catchment populations.

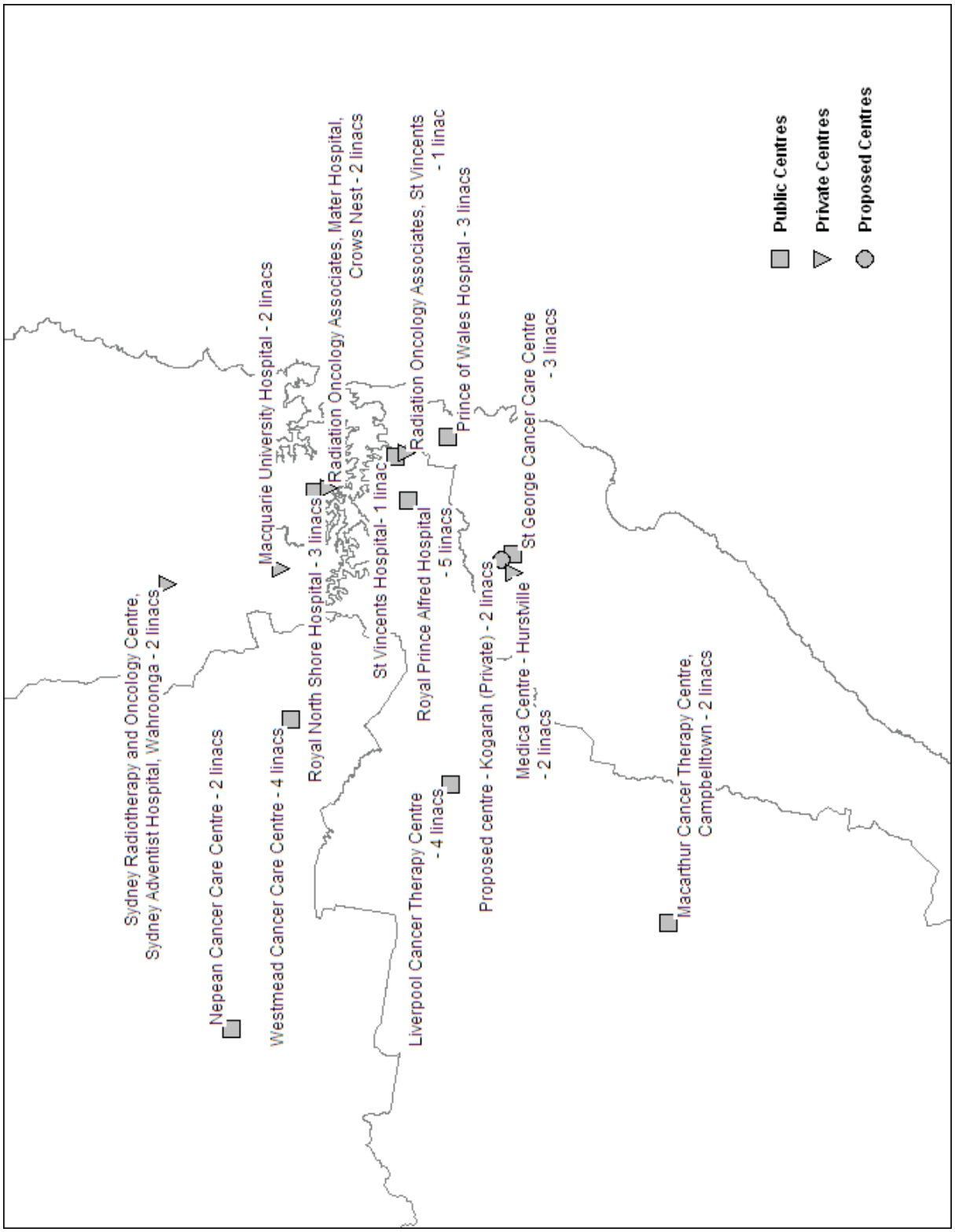
19 ABS Estimated Resident Population, Statistical Local Areas, New South Wales, June 2007 Release

20 NSW Health Population Projection Series 1.2009 Department of Planning & Statewide Services Development Branch, NSW Health, March 2009.

Map 1: Current and Planned Capacity, as at June 2010 – NSW



Map 2: Current and Planned Capacity, as at June 2010 – Metropolitan Sydney



4 Planning principles

The ROJIG in its *Radiation Oncology Service Development Framework* [21] developed a range of guiding principles to assist all jurisdictions in promoting achievement of a common goal of optimising cancer care through the provision of high quality, accessible radiotherapy services. These were consistent with the direction of service development in NSW, and were agreed by jurisdictions, to guide future services development. The Framework also emphasised a commitment by all levels of government to radiotherapy services integrated with the range of sub-speciality disciplines as part of a comprehensive cancer service.

The Framework remains a key platform for planning radiotherapy services and reinforces the importance of planning services in conjunction with other cancer-related services.

These service development principles are as follows:[22]

- Radiation oncology is to be provided as part of a comprehensive and multidisciplinary approach to cancer care that supports optimal cancer management. This provides an organisational framework to ensure that the needs of cancer patients and their carers are met through networking of cancer and support services.
- Radiotherapy services should be integrated with a number of subspecialty disciplines such as medical oncology, surgical oncology, clinical haematology, palliative care and rehabilitation, as part of a quality comprehensive cancer service. On-site or networked services in supportive care, psychosocial assistance and pharmacy services will also be provided by a range of health professionals.
- Sites for radiation oncology services need to have a sufficient level of clinical services, such as diagnostic imaging, nuclear medicine, pathology, intensive care and pharmacy services.
- Appropriate outreach services should be provided to improve access to patients living in rural and more remote areas through both locally based and outreach services.
- Radiotherapy is part of a service continuum, which should be inclusive of primary care providers. Therefore, recognition of the roles of GPs, community-based services and other non-institutional-based care is essential.
- Appropriate support should be provided, including low cost accommodation near to the service for rural patients and carers.
- Provision should be made for appropriate maintenance, upgrade, and replacement of all equipment involved in the provision of this service.
- Expansion of services will be based on the consideration of a range of factors including increasing geographical access, workforce supply, critical mass, and increasing treatment rates.
- A mechanism for collaboration and effective working relationships between the private and public sectors, particularly in regard to planning future services and data collection and reporting, should be established at all levels.
- Formalisation of cancer service networks should be undertaken.

21 Radiation Oncology Jurisdictional Implementation Group (ROJIG). Final Report September 2003. Part 2 "Radiation Oncology Service Development Framework"

22 Ibid pp 24-25

4.1 Planning parameters

Not all cancers will require radiotherapy as part of the treatment process. The RORIC Planning Forum supported the adoption of the Collaboration for Cancer Outcomes Research and Evaluation (CCORE) recommendation [23] of 52.3% radiotherapy utilisation rate for planning purposes. This research, completed in 2003, using evidence available to that time, estimated that overall 52.3% of all cancers would benefit with radiotherapy treatment. NSW follows this planning parameter.

Following consideration of changes in treatment methods and technologies; cancer patient survival rates and other related matters; as well as the need to monitor and periodically review the assumptions underpinning the planning benchmarks, the Commonwealth Government has indicated that financial support may be given to a review of the optimal proportion of new cancers that would benefit from radiotherapy.

The NSW Radiotherapy Strategic Plan uses the following planning parameters:

- 25% re-treatment rate
- 19 attendances per course
- 4.1 attendances per hour
- 8 operating hours per day
- 240 working days per annum

These parameters results in an expected throughput of 414 total courses per linear accelerator, per annum. This comprises 331 new courses of treatment, and 83 retreatment courses. It is acknowledged that many ROTCs operate extended hours; operate on weekends; and, attendances and throughputs may vary. This is part of usual planning processes and emphasises the need to have accurate, comparable workload data so as to review and refine these parameters is an important objective for the Department. The recent Business Process Improvement program at public ROTCs demonstrated that increases in treatment capacity can be achieved in a majority of cases.

23 Delaney GP., Jacob S., Featherstone C., Barton MB. Radiotherapy in Cancer Care: Estimating Optimal Utilisation from a Review of Evidence-Based Clinical Guidelines. Collaboration for Cancer Outcomes Research and Evaluation (CCORE), Liverpool Hospital, Sydney, Australia, 2003.

4.2 Estimation of future requirements for radiotherapy services

Planning for future services incorporates a number of factors and data, the most significant of which is data on population growth and estimated number of cancer cases as follows.

- NSW Health population projections have been prepared by the NSW Department of Planning. For the purposes of planning, the smaller population catchment areas of the former Area Health Services (prior to amalgamation) have been used as they more clearly identify patient flows within the State and to interstate services.
- The CI NSW provides cancer incidence projections to 2021 by Area Health Services. Projections of cancer incidence provide a valuable indication of the current and future expected burden on the NSW health system. They can better inform planning and decision-making, and assist in the efficient allocation of resources to meet the future needs of the health system for the prevention, detection, and treatment of cancer.
- Information on radiotherapy service delivery has been collected on an ongoing basis by NSW Health since 1990. With continued refinement and enhancement of the collection, a comprehensive information data set on radiotherapy services known as the Radiotherapy Management Information System (RMIS) is collected annually. It provides details of radiotherapy service configuration and referral patterns. NSW leads all States and Territories in the collection and utilisation of radiotherapy treatment data for service development. This data collection is very important, as radiotherapy is predominantly a non-inpatient service and data is not available under the majority of existing health data collections. The RMIS allows regular review of the planning parameters used.

- Current data regarding service capacity and expected expansion to service capacity is utilised.

4.3 Projected demand for radiotherapy services to 2016

The CI NSW data shows that the projected number of all cancer cases in NSW to 2016 is 45,210. The projected number of cases estimated to require treatment with radiotherapy by 2016 is 29,386. This is based on achieving a capacity for 52.3% of the projected new cancer cases, as well as providing for approximately 25% of cases which may require retreatment.

In considering the factors which impact on where people might receive their treatment, and therefore the planning of service development, scenarios are developed which consider various options. If all residents of NSW were to receive their radiotherapy treatment in NSW, this would require the equivalent of 71 linear accelerators by 2016. However, a proportion of NSW patients choose to have radiotherapy treatment at ROTCs outside NSW, as these services are in closer geographic proximity to their residence; or these services also often provide outreach services to those areas.

Public and private radiotherapy services in Queensland, ACT, Victoria and South Australia provide radiotherapy to NSW residents. Public and private ROTCs in those states have provided data to NSW Health over a number of years, showing the number of courses provided annually to NSW residents and the Area Health Services in which they reside. This data has allowed a clear profile for planning future radiotherapy requirements for these areas.

Some interstate patients also receive treatment at NSW ROTCs. When flows of NSW residents to and from interstate are considered, this equates to about 4.1 machines. Therefore the overall requirement for treatment capacity, by 2016, is estimated at 67 linear accelerators. 61 linear accelerators are proposed to be in place by 2016:

- 46 machines in public and private centres (as at June 2010);
- Nine additional machines: Illawarra Cancer Care Centre (1); Liverpool Cancer Therapy Centre (1); Port Macquarie (1); Lismore (1); Shoalhaven (1); Central Coast public (2); Tamworth (1); and Orange (1);
- Based on advice from the Commonwealth Government regarding private applications for Radiation Oncology Health Program Grant (HPG) funds, six new private machines are proposed to be in place by 2016: Macquarie University (2); Kogarah (2) and Hurstville (2).

The areas of need to 2016 are the Hunter (2) and western Sydney (3). Additional physical capacity is available at Tamworth, Orange, and Liverpool for another three machines which will address future demand in these geographic areas. There are also some 'partial' machine requirements that account for the balance of estimates.

It is recognised that there is a greater level of uncertainty in assumptions, the further out that the planning timeframe extends. As revised projections become available, or as planning assumptions are updated, estimates of machine requirements will be modified accordingly.

Scenario planning

5

A number of planning scenarios were developed to determine the most likely distribution of demand for services across NSW, and a possible range of supply options. The planning scenarios were based on the demand projections to 2016, as well as a qualitative estimation of how patient flows would change as new services came into operation. The scenarios included those NSW service expansions which were known at the time of writing.

Key factors, such as the critical mass of population and the sustainability of a workforce to deliver services, were considered in the proposal for new radiotherapy services. Radiotherapy services have a critical mass threshold which necessitates a minimum throughput that is large enough to ensure that appropriate levels of clinical staff are available and professionally supported; that there is effective employment of these staff; and that the service is able to be developed with other complementary clinical services.

The data for each planning scenario were analysed by former Area Health Service, and by service supply, arranged by Hospital. Various iterations of the planning scenarios were informed by clinicians, and Health Service managers and planners, to check on the validity of the assumptions and to utilise local expert knowledge of patient flow activity.

The planning scenarios have also been considered by the previous membership of the Radiotherapy Joint Advisory Committee (RJAC). The RJAC included representatives of radiation oncologists, radiation therapists and medical physicists from public and private ROTCs in NSW, a consumer representative, an academic representative, the CI NSW and NSW Health. The RJAC was jointly convened by the CI NSW and NSW Health.

Patient flows to existing and proposed ROTCs were based on the following.

- The actual flows identified in 2005 and 2008 in the RMIS data. This reflected the proportion of NSW residents receiving radiotherapy according to the former Area Health Service in which they reside, and at which ROTC the treatment was delivered. Former Area Health Services were used in preference to current Area Health Service as the smaller geographic areas allow for greater detail and 'granularity' of patient flow data.

- Individual patient flow assumptions for 2016 based on assessment of travel, related services and local Area Health Service knowledge of patient flows.

The scenarios included consideration of current ROTCs and new service expansions:

- expansion of existing services including Calvary Mater Newcastle (five), Royal Prince Alfred (five), and Liverpool hospitals (where there is capacity for 5 machines to 2016);

- new public services at Orange and Lismore,

- expansion of capacity at Coffs Harbour (two) and Port Macquarie (two);

- new private services that the Commonwealth Government advised had been approved at that time for receipt of Radiation Oncology Health Program Grant (HPG) funds.

5.1 Example of a demand for service scenario (Appendix 4)

The RMIS data collection includes how many new cases of cancer for each year were treated by each ROTC, and the Area Health Services in which those patients reside. This 'Demand for Service' data is reported in the RMIS as Source of Referral. In the 'Demand for Service' table, each former Area Health Service is listed. For each Area, the ROTCs at which residents of that Area received their radiotherapy treatment are listed, including interstate ROTCs. This 'source of referral' data for new radiotherapy courses for 2008 as reported in the RMIS 2008 report, was used inform the scenario. A de-identified extract from the 'Demand for Service' table is provided at Appendix 4, to illustrate the process.

Having 'actual' patient radiotherapy data over a number of years, as reported in the RMIS, provides a robust basis on which to estimate the number of NSW cancer patients who are likely to receive radiotherapy treatment at the various centres into the future.

Using the Cancer Institute 2009 cancer projections for 2016, and the planning parameters, a total estimate of cancer cases requiring radiotherapy for each Area Health Service to 2016 was calculated, and from this, the number of linear accelerators required for each Area if all residents of the Area were to have their radiotherapy treatment within the Area.

5.2 Service supply arranged by hospital / ROTC

Data from the 'Demand for Service' table directly translates into the service supply table, but arranged by the ROTC rather than by the Area Health Service. The total number of cancer cases estimated to require radiotherapy to 2016 is the same in both tables, but presented either by Area Health Service or by ROTC.

This table includes all NSW public and private ROTCs in existence in 2010, other states which provided radiotherapy treatment to NSW residents, as well as 'proposed' ROTCs services identified as areas of need. Presentation of the data in this table shows the number of funded machines at each centre as at June 2010; and, the projected machine requirements for each centre to end 2016. A de-identified extract from the 'Service Supply arranged by Hospital / ROTC' table is provided at Appendix 5, to illustrate the process.

Estimates of how many cancer patients could be expected to be treated at new centres were assisted by advice provided by the Area Health Services, as well as using inpatient data for other cancer services as a future indication of patterns of service delivery.

5.3 Patient inflows and outflows from Area Health Services

A number of NSW residents receive their radiotherapy treatment at interstate centres, usually because of geographic proximity but sometimes due to family / carer support. In addition, a number of interstate and overseas residents received their radiotherapy treatment at NSW ROTCs. The net outflow of NSW patients, equivalent to a certain number of linear accelerators, is subtracted from total estimated 2016 linear accelerator requirements to result in a net linear accelerator (linac) requirement.

Factors influencing planning of services

6

6.1 Configuration of services

As agreed at a national level, radiotherapy services are to be provided as part of a comprehensive and multidisciplinary approach to cancer care that supports optimal cancer management.

Comprehensive cancer care services provide multidisciplinary care, comprising complex subspecialty surgical oncology, medical oncology, haematological oncology, radiation oncology, psycho-oncology and research. The services need to be supported by pathology, imaging and other related services such as intensive care, operating theatres and allied health. Comprehensive cancer care services benefits patient care and clinician support. Education and training; strong links with inpatient and community palliative care services; and, patient support are other important elements of a comprehensive service. [24] This approach facilitates the use of multidisciplinary teams in diagnosis, treatment and management to the highest possible standard of care.

Planning for new rural and regional centres include a detailed scoping of services to be provided on site and where required, networking with a principal referral hospital for more complex services. Planning includes consideration of overall service needs of the residents including establishing referral pathways and clinical networks for complex radiotherapy treatments; and developing service level agreements for the delivery of a range of services such as clinical peer support, emergency treatments, education, and crisis management. Further work will be undertaken for new centres to establish formal cancer networks that link rural and regional ROTCs with principal referral hospitals where required, taking into consideration the overall service needs of residents. Partnering arrangement will have an impact on workload and resource requirements.

24 Radiation Oncology Jurisdictional Implementation Group (ROJIG). Final Report September 2003. Part 2 "Radiation Oncology Service Development Framework" p. 24

All NSW centres will continue to be built with a minimum physical infrastructure for two bunkers, providing capacity for two linear accelerators over time as needed. Where appropriate, the footprint of the buildings will also allow for future expansion.

A National Single Machine Unit (SMU) Radiotherapy Trial was established as a joint initiative between the Australian and Victorian Governments following recommendation in the 1998 Review of Radiotherapy Services in Victoria.

The trial included sites at Ballarat, Bendigo and in the Latrobe Valley.

The trial aims were to:

- improve access to services for people living in rural areas;
- improve utilisation rates of radiotherapy as a treatment modality; and
- increase the proportion of cancer patients receiving radiotherapy, thereby reducing the economic and social costs associated with other forms of treatment, including surgery.

The SMUs operated within a 'hub and spoke' model, linked to one or more larger centres. This model incorporated quality assurance guidelines and strong professional linkages between the hub and spoke sites, and facilitated appropriate treatment and referral practices. SMUs were not expected to provide treatment for complex cancers, and patients with these tumours were to be referred to the hub or other specialist facility.

The evaluation of the trial indicated that radiotherapy services should initially be established with (at least) two bunkers to allow for service expansion over time, or capacity to ensure that expansion can occur. By the end of the trial in 2008, each of the SMUs was anticipating expanding to two linear accelerators in the near future.

The Trial Steering Committee noted that single machine services could be considered as interim stages in the development of larger services. This position supports the NSW service development position.

In terms of deciding the location of radiotherapy facilities a number of factors need to be considered including population distribution and size; relationships with clinical and support services; workforce training and availability; maximisation of patient access; and, clinical viability. In line with the service configuration requirements, proposed radiotherapy facilities need to be part of comprehensive integrated cancer care services.

6.2 Patient access

Access to radiotherapy services might be considered across a number of dimensions, which are affected by socio-economic circumstance, age, or place of residence.

People in rural and remote areas consider a number of factors when deciding treatment options with their doctor. One of these factors is the disruption it may causes themselves and their families/carers in receiving treatment.

Other service providers including those for renal and cardiac services have encountered similar situations. In addition, travel times to get to treatment centres may be exacerbated by poor, or a lack of, public transport; long distances; or, poor quality roads, which result in longer or uncomfortable travel times.

The resource intensive nature of cancer service delivery, and the need to achieve a balance between service access and quality of care, precludes the provision of all forms of cancer care at all locations. [25]

The report *Mapping Rural and Regional Oncology Services in Australia* suggests that rural and remote Australians may have relatively poorer access to cancer treatment and support compared with populations in larger cities. [26]

In rural NSW, it is clear that population distribution and distance between communities means that either residents or health professionals have to travel to receive and provide services. However wherever possible, services will be provided closer to home where quality sustainable services can be provided. [27] The location of regional cancer centres should be determined by the availability of existing infrastructure and an analysis of population density and future community need. [28]

Development of ROTCs in regional areas requires a critical population mass in order to sustain a quality service. The need to ensure a safe, quality and sustainable service remains paramount. As such, the location of rural services has carefully considered a range of critical factors, and the service development has been well supported to maximise establishment of quality, sustainable services.

6.3 Outreach services

Cancer outreach services provide consultations by visiting specialists to locations where there are no resident services. Regular and frequent cancer outreach services are important in promoting and improving access to radiotherapy services, together with appropriate support services, such as palliative care for residents. They also provide a mechanism for referral to ROTCs.

The arrangements for outreach services need to be based on an assessment by the relevant Area Health Service of a demand unable to be met from resident clinicians. These services need to be well supported and care co-ordination structures need to be embedded to assist patients "between visits". Area Health Services in rural locations need to ensure appropriate planning for outreach services and development of formalised networks, to ensure these occur in the towns, and at a frequency, to meet need.

Planning for outreach clinics should give due consideration to a comprehensive approach whereby medical oncology and radiation oncology consultative clinics are provided

25 ROJIG. Final Report September 2003 Part 2. p. 29

26 Clinical Oncological Society of Australia (COSA). Mapping Rural and Regional Oncology Services in Australia, COSA, March 2006.

27 The NSW Rural Health Report – the Report of the Rural Health Implementation Coordination Group. Sydney, 2002.

28 Clinical Oncological Society of Australia (COSA) and The Cancer Council Australia Bringing Multidisciplinary Cancer Care to Regional Australia: Requirements for a Regional Cancer Centre of Excellence" p. 2 (2007?) http://www.cosa.org.au/File/Reports/RegionalCancerCentreofExcellencedocument.pdf

conjointly, ideally from the same centre. A networked approach should be adopted to provide potential benefits in regard to staff training and other service linkages. These networks may be between smaller services i.e. rural to rural, or between services of varying complexities, i.e. rural to urban. Critical mass of patients is another factor to be considered by Area Health Services in a strategic approach to the planning, placement and delivery of cancer outreach services.

NSW rural residents generally access radiotherapy services at centres in close geographical proximity to their Area Health Service, or at centres that provide Outreach Clinics in their Area Health Service. However, patients may choose to receive treatment at centres where they have family and other carer support. It is noted that where specialised radiotherapy treatment is required, such as paediatric oncology, some patients need to travel to a metropolitan centre, even though another centre may be in closer geographic proximity.

Innovative approaches to outreach services also can assist patients in reducing visits required to the treatment centre. For example, remote radiotherapy planning of patients now occurs at Dubbo. The implementation of this service development demonstrates that benefits, including enhanced access, can be achieved for people in rural and remote areas in an effective and cost efficient manner. The enhanced services for the Dubbo catchment population make the treatment process somewhat easier through the reduction in travel for the planning component, and pre and post consultations available through the outreach clinics.

In 2008, outreach services were provided by both public and private centres, servicing the populations of all Area Health Services. Some of the clinics have been operating since the 1970s; others have commenced since 2007, to service a growing demand in particular areas.

6.4 Transport and accommodation

As a means of ensuring access, cancer care services need to ensure that patients needing to travel for care have access to appropriate transport and low cost accommodation facilities. These support services are key to a patient's continued health and ongoing treatment.

The need for accommodation for patients, families and carers is not specific to radiotherapy treatment services, but is an integral part of overall service development. The length and frequency of radiotherapy treatments have a particular impact on patients as a result of the protracted nature of a course of treatment, impacting on those who may have to travel some distance for their daily treatments.

Area Health Services include transport and accommodation requirements in planning the development and delivery of the wide range of health services, including cancer services and radiotherapy. The funding strategies to respond to transport and accommodation needs must also be identified in this planning. There are a variety of models in place across the public health system. These include self contained units at subsidised rates; single and double rooms in dwellings converted from existing nurses' quarters; and, purpose built accommodation in the newer facilities, often funded by the community.

The support of the community and non-government sector in assisting to meet these needs is acknowledged and service providers are encouraged to develop collaborative arrangements with other agencies as required.

The *Transport for Health policy (July 2006)* [29] is the means by which NSW Health is working to improve access to health facilities for transport-disadvantaged patients and between facilities for those needing to travel to other sites for health services. It includes the Isolated Patients Travel and Accommodation Assistance Scheme (IPTAAS), which recognises that people living in isolated and rural communities experience particular difficulties in having to travel long distances for specialist medical treatment and aims to reduce the impact of this disadvantage upon the health of individuals and communities.

The Government's response to the Special Commission of Inquiry into the NSW Acute Care Health System is *'Caring Together – The Health Action Plan for NSW'*.[30] Recommendation 14(a) is that the compulsory patient co-contribution be abolished for pension and concession card holders for the IPTAAS making it easier for people

29 NSW Department of Health, Transport for Health. Sydney: NSW Department of Health, 2006. State Health Publication No. PD 2006_068.

30 Caring Together – the Health Action Plan for NSW. Sydney, NSW Department of Health, 2009.

who need to travel to access specialist treatment. This recommendation has been accepted by the Government, and took effect from 1 July 2009.

6.5 Complex treatments

As with many other clinical specialities as technology improves, it is anticipated that radiotherapy treatment will continue to increase in complexity. This raises a number of issues for planning, including the size of the patient population for which these new, or more complex treatments, may be suitable; the skills and expertise of the required clinical workforce; and, the evaluation of the relative benefit and cost effectiveness of these treatments, in comparison to both existing radiotherapy and other cancer treatments.

In response to these issues there will be a need to more strategically evaluate these changes, and make decisions about how these should best be delivered.

NSW Health takes account of access, quality of care and service efficiency when considering the number and location of highly specialised services. There are a number of factors that favour the decision for health care provision to be at limited numbers of sites, or to promote an integrated service network of sites and/or provider groups.

These include:

- when there is reasonable evidence that, up to a certain level, patient outcomes improve as caseloads increase and care needs to be concentrated to reach this level and support workforce skills and expertise.
- where there are large infrastructure costs and unnecessary duplication of services should be avoided to ensure efficient use of resources.
- when the medical technologies involved require further research, development and evaluation, and there is an associated need to enhance the diffusion of knowledge in the area.

Whilst consideration has been given to issues in relation to paediatrics, Stereotactic Radiosurgery (SRS) and, most recently, low dose brachytherapy for prostate cancer, there has been limited detailed planning in relation to other technology changes or sub-specialties. It is anticipated that there will be a need to look at other developments more closely, over the life of this Plan.

The specialised equipment used to deliver the treatments, such as SRS for head and neck cancers, and cost of radioactive seeds for the delivery of brachytherapy, identify that a strategic approach to the delivery of these services is required, especially within the context of high upfront capital investment and ongoing service costs. It is also noted that a number of conditions treated with SRS are also able to be treated using interventional neuroradiology procedures, so access to multidisciplinary teams to identify the most appropriate treatment option is very important.

A number of factors including incidence, workload, equivalent treatment options, and workforce were considered in relation to the public sector provision of low dose brachytherapy for localised prostate cancer.

Information from both national and international sources was considered including the United Kingdom Report *Advice on the Development of Low Dose Rate (Permanent Seed Implant) Brachytherapy Services for Localised Prostate Cancer in England* [31], and the NICE Report. [32]

As well as the general considerations outlined for the planning of specialised services, there are other factors relevant to sub-specialised radiotherapy services as follows:

- individual clinician workload – consideration of a minimum number of cases per year in order to maintain expertise;
- a minimum number of patients treated by the sub-specialisation centre per year to ensure a quality service;
- there should be appropriate referrals and clinical networks to provide access to the service;

31 United Kingdom Department of Health Advice on the Development of Low Dose Rate (Permanent Seed Implant) Brachytherapy Services for Localised Prostate Cancer in England (DoH Nov 2006) p. 15

32 National Collaborating Centre for Cancer. Prostate cancer: diagnosis and treatment – developed for the National Institute of Clinical Effectiveness (NICE) by the National Collaborating Centre for Cancer. Cardiff, Wales, NCCC, February 2008. www.nice.org.uk

- availability of appropriate facilities and equipment;
- the service should be part of the appropriate specialist multi-disciplinary team;
- availability of an appropriately skilled workforce;
- appropriate training and development, audit and research and development; and
- synergies with other treatment options provided at the same Hospital.

There are resource implications for establishing and expanding these types of complex treatments and there may be critical mass issues to consider in determining the number and location of the more highly specialised treatments. As such, Area Health Services will need to ensure that they use the *Model Policy for the Safe Introduction of New Interventional Procedures into Clinical Practice – A Model Policy for Area Health Services and Other Public Health Organisations*. [33] This policy document forms the basis for decisions as to whether to develop these services.

The provision of radiotherapy for the majority of children in NSW will continue to be undertaken at selected sites, that is, by those centres which are co-located with specialist Children's Hospitals, or which are closely networked and have formalised arrangements.

Referral should follow established paediatric service links, as described by the *Guidelines for Networking of Paediatric Services in NSW*. [34] This articulates the linkages which should be developed between Children's Hospitals and their referring hospitals and services. Because of the particular skills and resources required for treatment of children, paediatric radiotherapy is best done at a centre with experience in treating children. [35] Children being treated with radiotherapy have special needs and require management in combination with a paediatrician in close geographical proximity. For example, as radiotherapy requires the patient to remain immobile during treatment, sedation or anaesthesia of the child may be necessary to ensure adequate immobilisation. [36] This requires the adult hospitals to make appropriate arrangements for children.

If the number of paediatric patients should warrant it, the presence of a radiation therapist with paediatric experience can assist with streamlining communication, and coordinating the care needs of the paediatric patients.

6.6 New technologies

New health technology is universally considered to be a significant driver of increased health expenditure . [37] Radiotherapy is recognised as one of the more technically complex health services, and a number of the newer technologies are very expensive, for example, tomotherapy and proton therapy. The benefits sought through new technologies involve better targeting of tumours and sparing surrounding tissues. However, new techniques and technologies may often take longer in planning and treatment than those they supersede. It is also important to consider the resource investment required to establish new technologies and their opportunity cost for other health services.

It is also important to recognise that many technologies, including those associated with the planning and provision of radiotherapy, may undergo incremental and/or marginal changes in technology development. These changes do not necessarily result in a new technology; rather they will often reflect a change in the use of the technology. Some technology developments may change the way in which the technology is used, for example how the treatment is delivered. However this may not result in demonstrated improvements in patient outcomes.

33 NSW Department of Health. Model Policy for the Safe Introduction of New Interventional Procedures into Clinical Practice – A Model Policy for Area Health Services and Other Public Health Organisations. October 2003. http://www.health.nsw.gov.au/policies/PD/2005/PD2005_333.html

34 NSW Department of Health. Guidelines for Networking of Paediatric Services in NSW. Sydney, NSW Health, 2002. http://www.health.nsw.gov.au/pubs/2002/paedguide.html

35 Kramer S, Meadows AT, Pastore G, et al (1984) in Bast RC, Kufe DW, Pollock RE, Weichselbaum RR, Holland JF, Frei EF & Gansler TS (eds) (2000) "Cancer medicine" 5th edition, B.C. Decker: Ontario "Chapter 137C Principles of Pediatric Radiation Oncology"

36 Breneman JC and Narayana A "Principles of Pediatric Radiation Oncology" in Bast RC, Kufe DW, Pollock RE, Weichselbaum RR, Holland JF, Frei EF & Gansler TS (eds) (2000) "Cancer medicine" 5th edition, B.C. Decker: Ontario

37 Productivity Commission Research Report. Impacts of Advances in Medical technology in Australia. Australian Government, 2005.

Factors influencing planning of services

A full assessment of the technology may not be required for these marginal changes in technology development. However, they do need to be considered with regard to the level of investment and the benefit obtained.

In addition, many of the "options" now available to "enhance" linear accelerators also have the potential to significantly increase the cost of the machines. The accompanying evidence of improved clinical outcomes is often difficult to provide due to the nature of the technology.

NSW Health operates in an environment where health technology has to compete with other areas of health expenditure, given finite resources. As a result, a process of prioritisation is required when considering investment in health technology, with due consideration of a number of statewide and local issues, including the safety, effectiveness, quality, and accessibility of the technology in question.

It is therefore proposed to establish a more formalised approach to determining how these new technologies or more complex care is distributed.

It is noted that there has been much discussion regarding issues surrounding research into the effectiveness and the cost-effectiveness of new radiation oncology equipment. The Commonwealth Government has contracted the Trans Tasman Radiation Oncology Group Limited (TROG) to undertake a project with the objective of establishing a generic research framework for the evaluation of new technologies and treatment in radiation oncology, and to test the framework on Intensity Modulated Radiotherapy (IMRT) and Image Guided Radiotherapy (IGRT).

For the TROG project, new technologies are defined as those not on the Medical Benefits Scheme. This project commenced in January 2010. The framework will be developed so that it can be used to undertake a robust economic analysis of new radiation oncology technologies and treatments. Outcomes of this process will be considered.

A number of processes are in place for health technology assessment (HTA) in NSW. These are outlined in Appendix 2.

Some of the factors for consideration when reviewing the implications and benefits of introducing new technologies include the following.

- The requirement for good quality evidence. While there are many clinical trials comparing drugs, it is recognised that there are few phase III randomised clinical trials are available that compare one radiotherapy technology with another. However, strong emphasis needs to be given to level 1 clinical trials. Adoption of equipment by other States, territories and other countries including feedback on experience with this equipment should also be assessed in the Australian context.

- Estimated catchment population and utilization required for effective and efficient service delivery.

- Issues of critical mass of staff or workload. For example, a critical mass of staff with the appropriate expertise need be recruited and new staff trained to an appropriate level. If the equipment is new to the state or country then overseas training, or trainers from overseas, may be required.

- Cost implications, including cost effectiveness is another factor. The capital cost of new radiotherapy equipment is relatively high; this is balanced against patient throughput over a number of years of the life of the equipment. New equipment needs to be able to prove its cost effectiveness in terms of patient throughput. If the throughput is less than for conventional linear accelerator equipment then a case has to be made that superior treatment and patient outcomes are delivered in particular clinical sites than with conventional linear accelerator equipment. This may include tumour control or normal tissue complication or less secondary cancer formation.

- Impact on patient management and service provision.

- New technology should match Radiation Information System requirements and needs to be considered within the current service provision model.

- Planned investment and / or disinvestment, depending on the evidence developed.

- If the equipment is very new, and of comparable cost to linear accelerator technology, a trial on behalf of the state may be of benefit with one machine purchased and investment or disinvestment recommendations made after a review period. However, the opportunity cost for resources being used to purchase this new technology rather than another linear accelerator that could be delivering treatments needs to be assessed. The issue of whether Medicare and HPG payments are, or are likely, to be made for the new technology is also an important factor.

- If the new technology represents a large investment (eg Proton accelerator) or requires a larger population base, then a national centre might be considered, as a first phase. If appropriate, the technology may be considered as a possible Nationally Funded Centre (NFC). [38]

- It is essential when considering the introduction of new technology to consider whether previously introduced new technology which was made available (e.g. IMRT) was actually implemented clinically and widely. If not, then questions should be raised as to the suitability, viability and cost effectiveness of the introduction clinically of even more new technology (for example, Tomotherapy). Complex treatments should be provided at a limited number of sites, according to population need and availability of requisite clinical support services and workforce.

It is important that information on patient outcome and management is collected and reported where new technology is introduced. One approach would be to collect the data using the Radiotherapy Information System capabilities, which may or may not be currently used, or other medical oncology computerised data systems available where medical oncology services are also provided.

It is recognised that few phase III randomised clinical trials are available for radiotherapy technology. An alternate approach would be to explore the development of a set of principles to help guide decision making for a new investment. A principle may be that any deviation from a 'standard' equipment profile is justified by a measurable clinical benefit, which could be demonstrated by modelled evidence.

Modelled evidence could include factors such as safety (reduction in radiation delivered to healthy tissue), effectiveness (a measurable benefit in improved targeting of the tumour) as well as improved safety for the operators of the equipment. There must be a measurable benefit compared to existing technology and practice, in order support an investment in the new technology. Further discussion would be required in order to determine what would be regarded as a measurable clinical improvement, as well as coming to an agreed understanding of what outcomes are meaningful.

As outlined above, the planning and delivery of radiotherapy treatments have both become increasingly complex. Given the high cost of complex sub-specialised treatments and associated new technologies; and the other factors that must be considered in establishing the services, the statewide planning of radiotherapy services will move towards greater consideration of sub-specialisations and the best location for delivery of those sub-specialised services.

38 Australian Health Ministers' Advisory Council (AHMAC). Nationally Funded Centres Guidance for Governance, Management, Funding, Establishment, Review; Australian Health Ministers' Advisory Council, January 2010.

6.7 Workforce

It is recognised that over the coming years, the health workforce – medical, nursing and allied health – will face many challenges. Ageing population; sub specialisation; attracting workforce to regional and rural areas; and, a trend towards demand for more flexible work arrangements, will each impact on the ability to maintain workforce numbers, as well as appropriate levels of experience.

Whilst these issues are not unique to the radiotherapy workforce, radiotherapy is recognised as one of the more technically complex health services. As such, specific strategies will need to be considered for these health professionals: radiation oncologists; radiation therapists; medical physicists; and, nurses in the specialist areas. As these specialist workforces are small in number, compared to many other health workforces, a small change in supply can result in significant impact to services.

Opportunities and professional support that are readily available in metropolitan ROTCs should ideally be available to staff regardless of geographic location. For example, telehealth can facilitate peer support and education, case review, and multidisciplinary team meetings. Opportunities for the professional groups to continue research initiatives and attend conferences are also important in attracting and retaining staff.

NSW Health has led, nationally, in developing a comprehensive suite of strategies to address recruitment and retention issues for these workforce groups. It has provided significant investment into the radiotherapy workforce as part of a commitment to develop a sustainable workforce. NSW Health's experience of these strategies is that educational support is a key success factor.

The strategies have encompassed the short, medium and longer terms to sustain measurable improvements in total workforce numbers; vacancy rates; remuneration; and, clinical experience. These include:

- initiatives for Radiation Therapist including establishing tutor positions; financial support for over 50 Professional Development Year (PDY) positions each year; enhanced remuneration and improved career structure; return to work programs and, overseas recruitment programs;
- initiatives for ROMPs including significantly enhanced remuneration; and
- continuing Professional Development and post graduate scholarships.
- registrar posts for radiation oncologists.

6.7.1 Radiation therapists

NSW Health and the Commonwealth Government have made significant and ongoing investments in ensuring that an appropriate radiation therapist workforce is available to provide cancer services for the residents of NSW. This has involved detailed forward planning, with estimates of graduate numbers forming the basis of workforce training and retention programs, and cancer service expansion.

The vacancy rate for radiation therapists has been declining since 2005. Prior to 2005, there had been significant staff shortages affecting the operation of linear accelerators, for example a vacancy rate of over 15% in 2001. In 2008-2009 the radiation therapist vacancy rate was around 3-5%. Every year since 2005, funding has been provided for approximately 50 graduate radiation therapists PDY positions in NSW, representing a commitment of approximately $14 million over the 2005-2009 period.

Estimating the required student intake numbers and the final number of graduates required to supply the radiation therapist workforce, for expanding and new centres, is an ongoing challenge.

Radiation therapy studies are available in NSW at either the University of Newcastle (as an undergraduate degree) or the University of Sydney. The radiation therapist undergraduate degree requires three years full time equivalent (FTE), followed by a one year PDY in order to attain full accreditation through Australian Institute of Radiography (AIR). From 2010 onwards, the University of Sydney is not accepting any new undergraduate students in the Radiation Therapy degree course, and the final cohort of undergraduate students will graduate in 2011. The undergraduate course has been replaced with the Master of

Radiation Therapy (MRT), which requires completion of a relevant degree (at least three years) plus the two year FTE, plus one year for PDY. The MRT course was first offered in 2007, and enrolments commenced in 2008. The University of Newcastle continues to offer its undergraduate course Bachelor of Medical Radiation Science (Radiation Therapy).

The responsibility for determining the actual number of places for courses at universities rests with the Commonwealth Government, in consultation with the universities. NSW Health will continue its discussions with the University of Newcastle, the University of Sydney, and the Commonwealth Government to monitor and inform student intake and graduate numbers, with a view to maintaining and seeking to ensure adequate numbers of accredited radiation therapists.

The decision by the University of Sydney to offer only an MRT program will have a significant impact on the radiation therapy workforce, given the anticipated expansion in radiotherapy services over the next 5 years in both the public and private sectors.

Based on the known number of current enrolments in first, second and third years at the undergraduate courses at both universities in 2010, and the known numbers enrolled in the first and second year of the MRT course in 2010, an estimate of the approximate number of graduates from NSW universities requiring a PDY has been made as follows:

- 2010 – 43;
- 2011 – 71;
- 2012 – 98; and
- 2013 – 76.

Estimating PDY requirements from 2013 onwards becomes more challenging. The final cohort of undergraduate students from the University of Sydney will graduate in 2011, and will undertake their PDY in 2012. The University of Sydney PDYs in 2013 will have commenced their MRT course in 2011, and so the numbers are not yet known. However, the University of Sydney estimates approximately 11 – 15 places in the first year of the program. There are approximately 61 enrolments for year one in 2010 at the University of Newcastle, who would be eligible for their PDY in 2013. Based on previous data, a proportion of undergraduate students does not complete the course, for example, some students transfer to other radiation science streams or other unrelated fields of study, or drop out for personal reasons.

Not all graduates from radiation therapy courses in NSW necessarily undertake a PDY in NSW. A small number of graduates undertake their PDY at private NSW centres, or at interstate centres (a number of states and territories do not have radiotherapy tertiary studies). Some students defer undertaking their PDY, or do not seek a PDY if they undertake further studies. A small proportion of students, although they have graduated, may be unsuccessful in obtaining a PDY when assessed by selection panels against the selection criteria for appointment to Medical Radiation Science (Radiation Therapists) Level 1.

While the availability of newly accredited radiation therapists is one aspect of workforce planning to consider, the level of experience across the workforce is also an important issue to consider.

NSW Health continues to fund positions that provide educational support. Each public ROTC now has at least one radiation therapist tutor position, which assists with organisation and clinical supervision of student clinical placements and mentoring PDYs.

Future directions

A National Health Workforce Agency, known as Health Workforce Australia (HWA) was established as part of the Council of Australian Governments (COAG) $1.6 billion health workforce reform package. HWA is a statutory authority established by the *Health Workforce Australia Act 2009* and will report to directly to Health Ministers.

HWA will advise Universities on the number and type of additional students required to meet projected workforce shortages to enable them to make informed decisions about the numbers of additional undergraduate health professional places that they choose to enrol from the commencement of the 2011 academic year and thereafter.

Factors influencing planning of services

The AIR developed a model in 2000 to be largely independent of the differences of technology, case mix and technical complexity. [39] The model reflects staffing levels required for linear accelerators, at both the planning and treatment stages. The basis used for determining staffing levels is total linear accelerator operating hours and not number of fields, attendances, courses or basic treatment equivalent (BTE). It recommended a radiation therapist staffing formula based on 1.06 FTE per linac hour (calculated at the level of a shift). The key assumptions include 1,720 hours per year and an 8 hour working day for radiation therapists. This formula specifically excludes kilovoltage and brachytherapy services (planning and treatment) as well as SRS / radiotherapy, total body irradiation, IMRT and paediatrics (planning only).

In 2009, the Workforce Working Group of RORIC engaged a consultancy to undertake a review of the status and capacity of the three main radiotherapy professional groups throughout Australia, and to formulate a methodology which will ensure reliable workforce planning can be conducted in the future; and identification of opportunities to address workforce and skills shortages. [40] This will further inform planning in NSW.

Attrition rates are an important element for the radiation therapist workforce. There are a number of factors that would indicate a lower attrition rate for NSW than is estimated at a national level.

- Analysis of radiation therapist FTE numbers for 2003-2008 in public and private centres as reported in the RMIS reports, shows that the FTE increased over the period by 32%. This increased to 35% when the PDYs for that period were included. The implementation of the tutor positions, as a strategy has also contributed to the retention rate.

- It is recognised that there were machine expansions during the 2003-2008 period. When excluding those centres with additional machines and the new Coffs Harbour and Port Macquarie centres, FTE in the remaining public centres with stable machine numbers increased by 19%. This may be related to more complex treatments and increasing number of treatments influencing the requirement of additional radiation therapist staff.

- The vacancy rate for radiation therapists continues to be low in NSW public centres. As at 1 July 2009, it was 2.3%.

- The current global economic situation may also influence a proportion of radiation therapists to remain in the workforce, when they otherwise may have considered leaving for various reasons.

Based on the above, an attrition rate of 7% is estimated for NSW. A number of data sources such as FTE radiation therapist data and PDY data, has been analysed.

2008 is used as the baseline year. 2008 data was collected as follows:

- 2008 radiation therapist workforce data from public centres vacancy data collected six-monthly;

- an average for private centre FTE over the last six years;

- known number of graduates undertaking their PDY in public and private centres in 2008 and the known proportion of those newly accredited radiation therapists who were employed in public centres (and the same proportion estimated for private centre employment); and

- the Universities' estimated numbers of places in their undergraduate and graduate radiation therapy courses.

Using the above data and a 7% attrition rate, it is estimated that the supply of radiation therapists at the end of 2009 was approximately 423. Applying these assumptions, as well as knowing that a number of centres are scheduled to commence in 2010 and so more recently accredited radiation therapists are likely to find employment in NSW, results in a supply of approximately 476 radiation therapists at 2011.

39 Australian Institute of Radiography (AIR) Radiation Therapy Advisory Panel (July 2001) Radiation Therapy Staffing Model, The Radiographer, Vol 48, No. 2, pp 79 - 83

40 In mid 2009, the Commonwealth Government engaged consultants to undertake a review of the current status of the radiation oncology workforce and to identify opportunities for supply of this workforce.

Using workforce data collected over the recent RMIS reports, as well as the more frequent radiation therapist vacancy reports collected for NSW public centres, indicates an average of nine radiation therapists per linear accelerator in public centres. This is consistent with the AIR 1.06 FTE formula.

It is noted that the Queensland Statewide Cancer Treatment Services Plan 2008 - 17 [41] indicated that the National Strategic Plan for Radiation Oncology [42] indicates an incidence ratio of 8.48 FTE per linear accelerator.

Using RMIS data as a guide, numbers of radiation therapists to be employed at private centres is estimated at 15% less than at public centres.

It is estimated that 53 machines will be in place by 2011. This is derived from 38 machines in public centres (including one additional machine at Orange), nine machines in existing private centres, and an estimated six machines at new private centres in the Hurstville / Kogarah area and at Macquarie University Hospital.

Using the above assumptions for these public and private centres, it is estimated that approximately 457 radiation therapists will be required if all 53 machines are operating in 2011. This is an estimate only and will be influenced by a range of factors, as discussed above, which can have a significant impact on such a small workforce group, including whether the new private centres approved by the Commonwealth Government for HPGs commence treatment by 2011. Support will be ongoing for recruitment, retention and training strategies. This will require partnership between the states, territories and the Commonwealth, to promote additional training places at Universities.

Additional radiation therapist workforce will be required for the radiation oncology departments of the new Regional Cancer Centres, as well as for the additional linear accelerators announced under the Commonwealth Government Regional Cancer Centre initiative (this initiative is discussed further at section 9.5). Under the Regional Cancer Centre initiative, funding has been announced for seven additional linear accelerators in NSW public centres, with estimated completion dates progressively to the end of 2014. These additional machines will require in the order of 70 additional radiation therapists, with varying degrees of seniority. Including the estimated 457 radiation therapists required as at 2011 results in an estimated total **requirement** of 527 radiation therapists by 2014 for 61 machines.

As outlined above, it is estimated that there will be a supply of approximately 476 radiation therapists at 2011. Using the assumptions of 7% attrition, and that all currently enrolled radiation therapy students successfully complete the course and PDY, results in a supply of 614 radiation therapists in 2014. However, evidence is that approximately 50% of first year undergraduate radiation therapy students will have dropped out of the course by the end of third year. Using these attrition assumptions, the expected **supply** of radiation therapists in 2014 would be approximately 500 radiation therapists.

These workforce estimates would be influenced by a number of factors. The estimated undersupply would be affected if any of the assumptions are significantly misplaced (for example, places in radiation therapy university courses are significantly increased, or drop-out rates change) or if additional machines commence in NSW to 2014 (for example, to service the areas of need in western Sydney and the Hunter) or proposed private centres do not commence.

41 Queensland Health. Queensland Statewide Cancer Treatment Services Plan 2008-17. January 2008.

42 Royal Australian and New Zealand College of Radiologists, Australasian College of Physical Scientists and Engineers in Medicine, and Australian Institute of Radiography. National strategic plan for radiation oncology (Australia). Sydney: RANZCR, 2001.

6.7.2 Radiation oncology medical physicists

Radiation oncology medical physicists (ROMPs) are responsible for applying fundamental scientific principles to ensure the safe and accurate delivery of the radiation dose to patients, and ensure a radiation safe environment exists within radiation oncology departments for staff, patients and visitors. They are involved in clinical consultancy, treatment delivery and verification, quality assurance and latest technology evaluation.

With the development of new radiotherapy services, especially in the rural and regional areas, an appropriate clinical staff skill mix is essential and the aim is to recruit staff in a timely manner to oversight the development and delivery of the service. Currently, there is a shortage of ROMPs in NSW, Australia and internationally (although noting that the vacancy rates in NSW public centres is falling).

With the quality assurance requirements for the commissioning of linear accelerators, it is essential that ROMPs with the appropriate skill mix and level of seniority and expertise, are in place to manage the commissioning process and ensure that the stringent quality assurance requirements are met.

Workforce issues with ROMPs have generally related to ensuring adequate post graduate clinical and academic education and training, as there is no specific undergraduate degree for ROMPs. This approach also aims to increase the proportion of "qualified" ROMPs in the workforce, that is, those ROMPs with adequate clinical experience or with accreditation from the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM). The focus for the ROMP workforce group has therefore been on establishing a formalised Training, Education and Accreditation Program (TEAP) and attracting graduates to suitable post graduate courses.

The aim of the TEAP is to provide a training and education package that enables a physicist to achieve the required knowledge and practical skills to be accredited by the ACPSEM in radiation oncology medical physics. As a result, the number of "qualified" ROMPs with adequate clinical experience or with the ACPSEM accreditation in public centres in NSW is increasing. Graduates usually have a science degree, usually with physics major.

The TEAP is expected to take between three to five years and comprises:

- an ACPSEM accredited postgraduate degree in Medical Physics;
- structured in-service clinical training working as a registrar in a radiation oncology department that has been accredited for the purpose of this training by the ACPSEM; and
- assessments and examinations.

NSW was the first Australian jurisdiction to introduce the TEAP in 2004, with 10 registrars. Since 2003/04, NSW Health, ACPSEM and the Chiefs of ROMP departments in public centres have worked collaboratively in relation to the introduction of TEAP, in improving training and supervision and the overall experience of registrars, as well as the long–term sustainability of the TEAP. This includes the need to identify an appropriate number of registrar positions in relation to the availability of permanent positions for registrars completing TEAP and the workforce requirements for new and expanded services.

In the first years after commencement of TEAP, there had been a relatively high attrition rate from the program in NSW. This was due to a number of interstate registrars who left the NSW program for permanent positions at a more senior level in their home state.

This trend has declined since other States commenced TEAP, with the advent of the enhanced remuneration in NSW, and with more FTE ROMP permanent positions being added to the overall numbers.

NSW Health continues to fund positions that provide educational support for radiation oncology. Since 2004, NSW Health has provided almost $1 million for educational support for ROMP registrars with the appointment of a clinical placement coordinator and the scholarship program; more than $1.4 million for the Continuing Professional Development grants to departments and to ACPSEM for the

development of educational support materials; an overseas recruitment program; and a chair of medical physics at the University of Sydney. Since 2004, NSW Health has provided more than $6 million for the salaries of supernumerary ROMP registrar positions. The vacancy rate for ROMPs has also fallen significantly as a result of these workforce initiatives. It is estimated that approximately 70% of supernumerary ROMPs have filled permanent positions in the NSW public health system.

Due to the ongoing extensive investment in ROMP workforce strategies, the number of accredited ROMPs has risen by over 38% from January 2007 to January 2010. A majority of public centres are staffed with "qualified" ROMPs, representing 96.1% of total permanent filled ROMP positions in NSW public centres. This is a rise of over 51% since January 2007. The ROMP vacancy rate in NSW public centres as at 1 April 2010 is under 11%. This represents one of the lowest vacancy rates for NSW centres collected over the past two and a half years, from a high vacancy rate of 25% in April 2008.

Based on funding allocated for 2010/11 for additional ROMP positions, it is anticipated that 21 ROMPs will become accredited in the public system during 2011 - 2015. However, it is difficult to project the exact numbers in the future for a range of reasons, for example:

- the number of ROMPs qualifying varies from year to year;
- not all public ROTCs in NSW were accredited for TEAP;
- some ROMPs have accelerated their progress in TEAP, and so have qualified earlier than expected;
- fluctuations in ROTC staffing levels, access to equipment (eg. brachytherapy), registrar performance in TEAP and their Masters, and changes in clinical supervisors for some ROMPs may delay accreditation;
- registrars in the 2010 TEAP may not take the full five years to complete the program due to exemptions for prior relevant experience or accelerated completion of the Masters degree.

Future directions

Variable estimates of numbers of medical physicists per number of patients, or per linear accelerator, are reported in the literature. The European Society for Therapeutic Radiology and Radiation Oncology (ESTRO) has reviewed the level of radiotherapy need in Europe and how it matches to capacity by country. [43] The work collected available guidelines for infrastructure and staffing throughout Europe. Analysis of the guidelines suggest to have one linear accelerator per 450-500 patients, one radiation oncologist per 200-250 patients and one physicist per 450-500 patients (or one per linear accelerator). The paper confirmed that these were crude guidelines and actual needs are heavily dependent on population structure, cancer incidence and treatment strategies.

The ACPSEM in 2000 developed a formula for staffing numbers for radiation oncology physics [44] Its "Formula 2000" assigns an FTE physics staff per item, in the categories of equipment related items, patient-related, miscellaneous, physics staff related, and other. By picking the relevant items and their associated FTE physics levels, the number of physics staff required for a particular service configuration can be calculated. Figures of 1.7 to 2.2 ROMPs per linear accelerator are variously quoted in the literature when using this tool. This is provided for overall guidance; much closer analysis is required for when reviewing individual centres' needs. It is acknowledged that this study was conducted in 2000 and would benefit from being reviewed to reflect changes in technology, complexity and treatment rates.

However, it is worth noting that there is a generally a lower proportion of qualified ROMPs per linear accelerator in the private sector compared to the public centres in NSW. The differences in outcomes have not been formally assessed. The differences between demand for ROMPs by public and private sectors will also affect the number of qualified ROMPs required. The RMIS 2008 report shows that there

43 Slotman BJ, Cottier B, Bentzen Soren M, Heeren Germaine, Lievens Yolande, Bogaert Walter van den Overview of national guidelines for infrastructure and staffing of radiotherapy. ESTRO-QUARTS: Work package 1 Radiation and Oncology Volume 75 (2005) pp. 349 e1 – 349.e6

44 Oliver Lyn, Fitchew Robert, Drew John "ACPSEM Position Paper Requirements for Radiation Oncology Physics in Australia and New Zealand" Australasian Physical and Engineering Sciences in Medicine 2001, 24(1): 1-18

was approximately 1.69 qualified FTE ROMPs per linear accelerator in the public sector, and 0.88 qualified ROMPs per machine in the private sector in NSW.

As outlined in the 'Radiation Therapists' section above, it is estimated that 53 machines will be in place by 2011, across public and private centres. Using an estimate of approximately two ROMPs per linear accelerator, there will be a requirement for 76 ROMPs in public centres by 2011. As at 1 January 2010, there are 86.9 FTE established positions across NSW public centres of which, 75.4 (86.8%) are filled.

By 2016, a further eight machines will be in place at public centres: Liverpool (1) Illawarra Cancer Care Centre (1); Port Macquarie (1); Lismore (1); Shoalhaven (1); Central Coast (2); and Tamworth (1). These machines will require an estimated further 16 ROMPs. By 2016, it is expected that there will be 61 machines in place, as outlined in Appendix 3. Using two ROMPs per machine as a guide, results in a total estimated requirement of 122 ROMPs for 61 machines by 2016.

Based on funding allocated for 2010/11 for ROMP supernumerary positions, it is anticipated that 21 supernumerary ROMPs will become accredited during 2011-2015. These 21 ROMP supernumerary positions added to the current 75 filled positions results in 96 filled ROMP positions by 2016 – a shortfall of approximately 26 positions. These are estimates only, and do not take account any of the following factors:

- any attrition from the NSW public system,
- any additional supernumerary registrar positions that may graduate by 2016,
- any potential rise in the ROMP vacancy rate,
- any additional machines added to the NSW system for the indicative additional capacity required in the Hunter and western Sydney, or
- if additional machines are funded for the additional physical bunker capacity at Tamworth, Orange, or Liverpool.

In NSW, the priority remains on training strategies to ensure there are enough qualified ROMPs for the new and expanded public services. The number of ROMP registrar position is constrained by whether ROTCs are accredited to conduct TEAP including whether the ROTCs have the appropriate ratio of qualified ROMPs to supervise registrars. While new public ROTCs are planned to commence, it may take some time for them to be accredited and be eligible to participate in TEAP.

NSW Health continues to explore avenues for funding of more ROMP registrar positions for public centres, while at the same time recognising that the numbers of registrars in this small workforce group varies from year to year.

6.7.3 Radiation oncologists

Radiation oncologists are a key part of the Radiotherapy workforce. Therefore, training of registrars is a key component for appropriate service delivery as well as encouraging medical students to consider specialising in Radiation Oncology.

The Royal Australian and New Zealand College of Radiologists (RANZCR), Faculty of Radiation Oncology is the specialist medical college responsible for the training and assessment of radiation oncologists. Speciality training as a radiation oncologist is undertaken after completion of a medical degree and at least two years post-graduate clinical training. To enter the training program, potential trainees first need to obtain a position at an accredited site. The Faculty accredits centres to provide training which meets standards in areas such as trainee to consultant ratio and a capacity and commitment to provide a quality teaching and learning environment.

A number of radiation oncology vocational registrar (ROVR) positions have been funded by NSW Health since 2002. The funding of these positions has aimed to improve the recruitment and retention of the specialists; to provide opportunities for increased rotation and exposure to practice in a rural setting; and to improve career opportunities for trainees wishing to practice in a rural setting. NSW Health continues to fund positions that provide educational support.

In mid 2009, the NSW Institute of Medical and Education and Training (NSW IMET) was commissioned by the CI NSW to oversee the development of a model for sustainable training networks for adult oncology based specialties, focusing specifically on medical oncology, radiation oncology, and palliative medicine, with the primary purpose to support NSW Area Health Services in the delivery of high quality oncology based training.

Two training networks (Northern and Southern) for radiation oncology registrars have been established to provide more consistent and efficient radiation oncology training. The networks extend from the departments in the Mid North Coast to Canberra hospitals.

The training networks are part of a broad strategy by the RANZCR to support the new radiation oncology curriculum and to provide more consistent and efficient radiation oncology training.

Future directions

The Australian Health Ministers' Advisory Council (AHMAC) report [45] indicated that the maximum number of new patient referrals that each radiation oncologist can manage was 250 per year. Almost fifteen years later, the RANZCR also determined 250 new cases per year as the acceptable workload for a radiation oncologist. [46]

It is noted that the RANZCR's self assessment form for radiation oncology departments to assess whether they can be accredited to provide training to registrars, includes at standard 5.1(b) that each FTE consultant see approximately 250 (range 150-350) new patients per annum. RANZCR has advised that this range is to cover those radiation oncologists who may be treating smaller numbers of patients due to the specialised nature of the field, for example, paediatric patients.

The projected number of cases estimated to require treatment with radiotherapy by 2011 is 25,917. A net flow of patients interstate, equivalent to approximately four machines, reduces the estimate of new cases to be treated in NSW by 2011 to 24,261 cases. Using the AHMAC guide of one radiation oncologist to treat 250 new cases, results approximately 97 radiation oncologists by 2011 for NSW.

The RMIS 2008 reports that there were 72 radiation oncologists employed in NSW centres. In addition, there were also 41 radiation oncology registrars in training. It is acknowledged that, whilst in training, these registrars do contribute to responding to a patient load.

As outlined earlier, the projected number of cases estimated to require treatment with radiotherapy by 2016 is 29,386. Using the AHMAC guide of one radiation oncologist to treat 250 new cases, results approximately 117 radiation oncologists by 2016 for NSW.

6.8 Workforce - review

All three workforce groups have seen expansions in numbers of FTE positions in public sector ROTCs. Using the RMIS, from 1998 to 2008, the total number of FTE positions (public and private) for:

- radiation oncologists (excluding registrars) has increased by over 67%;
- radiation therapists (excluding PDYs) has increased by over 70%; and
- ROMPs (excluding trainees) have increased by over 100%.

During the same period, the number of new radiotherapy cases treated at NSW public and private centres has increased by 33%. Measures such as the development of staff support positions like the ROMP Clinical Placement Coordinator and the tutors provided at each centre to support the continuing professional development of radiation therapists as well as support PDYs, these measures assist with the retention of those workforce groups.

Analysis of data provided for the RMIS reports shows variability between ROTCs regarding staffing levels in public and private centres. NSW Health will research the

45 Australian Health Ministers' Advisory Council (AHMAC) Working Party on Radiation Oncology (1986) Superspeciality Working Party Guidelines for Cancer Treatment Services (Chairman Dr Brendan Kearney), Canberra, AHMAC, 1987

46 Royal Australian and New Zealand College of Radiologists (RANZCR) Faculty of Radiation Oncology, Australian Institute of Radiography (AIR), and Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM)] (Tripartite Committee) National Strategic Plan for Radiation Oncology (Australia, August 2001.) p. 45

development of staffing profiles for each centre which reflect their volume, case mix and complexity. The work being done at the national level will assist in this process.

6.9 Service efficiency

Efficiency gains and improved patient throughout can be achieved by reviewing and improving a number of aspects of the operational management of centres. This was demonstrated by a Business Process Improvement (BPI) project which was undertaken for radiotherapy services in NSW in 2006-07 in conjunction with the CI NSW.

The project identified opportunities for improvements in the operational practice of service delivery in ROTCs. The principle objective of the project was to provide patients with improved access to radiotherapy treatment through better-coordinated and more cost-effective radiotherapy service delivery. The project included 10 ROTCs. A follow up BPI project was conducted in 2008 at the two North Coast Cancer Institute sites. Calvary Mater Newcastle Hospital had been involved in an earlier phase.

The project assisted the ROTCs in improving their operational performance. The project demonstrated that improvements in business processes, such as more efficient utilisation of patient bookings; improved schedules for liaison with radiation oncologists for signing off plans; improved procedures for gaining patient consent in a timely manner; and improved scheduling of clinic bookings and communications, have resulted in incremental increases in numbers of patients treated on the linear accelerators and reduced times from consultation to treatment completion. These improvements have been realised without additional costs, within existing staff and machine capacity, and with "buy-in" in the process improvements by the staff involved.

Improvements in patient throughput at the 10 ROTCs of more than 15% was achieved, and for those centres not constrained by shortage of referrals, the throughput grew by 20%. A report of the BPI project is available on CI NSW website. [47]

As part of sustaining these gains, funding support was provided to develop and roll-out to all ROTCs a suite of tools to support and promote operational excellence. The roll-out of these tools and training was completed in July 2009.

The tools developed are:

- Key Performance Indicator Management Tool. This tool uses data extracted from the centre's Record and Verify system to analyse and report on historical performance.
- ROTC Capacity Estimation Tool. This tool uses inputs to project future performance under different scenarios, and is useful for establishing and updating annual plans.
- Treatment Booking Support Tool help plan start dates for new courses.
- Radiation Therapist automated rostering system tool uses inputs to create fortnightly rosters.

The tools will assist with the ability to demonstrate the efficient use of existing capacity, and the likely requirement for more benchmark style data in the future.

Extending working hours to weekends and other options are available to consider for improving efficiency and utilisation of equipment. NSW has invested significant funding in radiotherapy services and exploring options to better utilise those resources are recommended. Research demonstrates the need for local evaluation of patient preference before the introduction of extended working hours, including weekends. [48]

The tools developed to assist in operational performance will also assist in reviewing staff rostering and treatment bookings options, as well as assisting in the costing of service extensions, consistent with the Audit Office 2009 report recommendations. There are a number of activities to be progressed to explore how infrastructure can be more effectively utilised and this is to be progressed over 2010. Work will be undertaken on this aspect which will inform future planning of radiotherapy services.

47 Cancer Institute NSW. Radiotherapy Business Improvement in NSW – A Business Improvement Strategy. Sydney, Cancer Institute NSW. July 2009. http://www.cancerinstitute.org.au/cancer_inst/publications/index.html#reports

48 Calman, F; White, L; Beckingham, E; Deehan, C. "When Would You Like to be Treated – A Short Survey of Radiotherapy Outpatients" Clinical Oncology March 2008, pp. 184-190.

As noted, jurisdictions at a national level have supported the adoption of the CCORE recommendation that 52.3% be used as the optimal utilisation rate for planning purposes. This rate was based on evidence available to 2003. There are a number of important challenges in reviewing planning targets to ensure that these reflect contemporary practice and consideration of the various treatment options available in NSW for people with cancer.

There will need to be ongoing assessment of cancer outcomes, and close monitoring of the role of radiotherapy, within the context of cancer treatments, in line with international best practice, both now and into the future.

Greater efficiency in the use of current resources, including workforce, will provide extra capacity at centres for the treatment of patients.

6.10 Research and education

Research and education are recognised as integral parts of cancer services. Research, including participation in clinical trials organised by cooperative groups, helps improve the efficacy of treatment, supports the maintenance of quality standards, and assists in workforce retention. It is expected that clinical research will mainly occur in publicly funded facilities. Laboratory research may occur in comprehensive cancer services, and opportunities should be available in Australia for the radiotherapy workforce to develop skills in basic research.

Education of new professionals is also an important part of ensuring the ongoing viability of radiotherapy. While planning for the three main professions (radiation oncologists, radiation therapists and ROMPs) is occurring through individual approaches, to ensure a sustainable workforce, plans for radiotherapy should consider the need to make sufficient training positions available in the public and private sectors, and distribute them appropriately between facilities. Providing continuing medical education to maintain competencies of the workforce is another important consideration. Avenues to maintain competencies need to be available for all clinical staff.

Development of a radiation oncology / radiotherapy research strategy which demonstrates research as a valued undertaking and a high priority throughout NSW is considered an important objective. Elements of the strategy would include basic research, clinical trials, health services research, new technology, radiation therapy and psychosocial aspects.

Areas of research expertise are evident at many individual centres. For example, the Prostate Cancer Institute at the St George Hospital provides a comprehensive range of treatment options for prostate cancer. The Ingham Health Research Institute in South Western Sydney Area Health Service includes a dedicated research bunker and linear accelerator. There is therefore an important opportunity to build on research in progress and develop a pro-active strategy to evaluate new technologies and integration of diagnostic and treatment technologies.

The NSW Office for Science and Medical Research (OSMR) plays a crucial role in bringing together the diverse strands of scientific and medical research endeavour in NSW and providing support and an increased public profile for the sector.

The CI NSW Research Division operates three main programs including Cancer Research Grants and Infrastructure Program, Cancer Research Ethics Program, and Clinical Trials Research Program. The CI NSW Research Program is designed to accelerate the translation of research discoveries directly into clinical practice.

It is also noted that the TROG, which is a cooperative multi-disciplinary organisation dedicated to the control of a wide range of cancers through quality multi-centre research, provides the infrastructure and governance for national and international collaborations for clinical research trials. This collaboration involves cancer treatment centres across Australia and New Zealand, and internationally.

Discussions will need to be progressed with the CI NSW and the OSMR on a research strategy for radiotherapy. Given that the nature of the roles of the OSMR and CI NSW in research, the future directions for research are not within the remit of this Radiotherapy Strategic Plan.

7 Expanded services to 2016

As outlined in Appendix 3, 61 linear accelerators are proposed to be in place by 2016:

- **46 machines** in public and private centres (as at 2010);
- **Nine** additional machines: Illawarra Cancer Care Centre (1); Liverpool Cancer Therapy Centre (1); Port Macquarie (1); Lismore (1); Shoalhaven (1); Central Coast public (2); Tamworth (1); and Orange (1);
- Based on advice from the Commonwealth Government regarding private applications for Radiation Oncology Health Program Grant (HPG) funds, **six** new private machines are proposed to be in place by 2016: Macquarie University Hospital; Kogarah and Hurstville.

The new private radiation oncology service at Macquarie University Private Hospital has capacity for two linear accelerators, and two private centres in Hurstville / Kogarah have capacity for four machines. There will be close monitoring of the establishment of these services as it is not appropriate to duplicate service provision, but equally, expansion needs to be encouraged in areas of need.

A private centre which was to be established at the Lingard Hospital in Newcastle had been approved by the Commonwealth Government for Health Program Grants. However, it is understood that this site is no longer under consideration.

Capacity in the private sector is taken into account as part of achieving the supply estimated to meet the projected demand. As previously indicated, the private sector will take into account factors other than population need, in determining locations for establishment of services. Additional capacity established by the private sector may not necessarily correspond with an area of need identified through the cancer and population data and the planning process undertaken in the public sector.

It is not until there is a demonstrated need for additional capacity approaching a 'total' machine that further planning is undertaken to deliver additional machine requirements.

Access to radiotherapy services in NSW

8

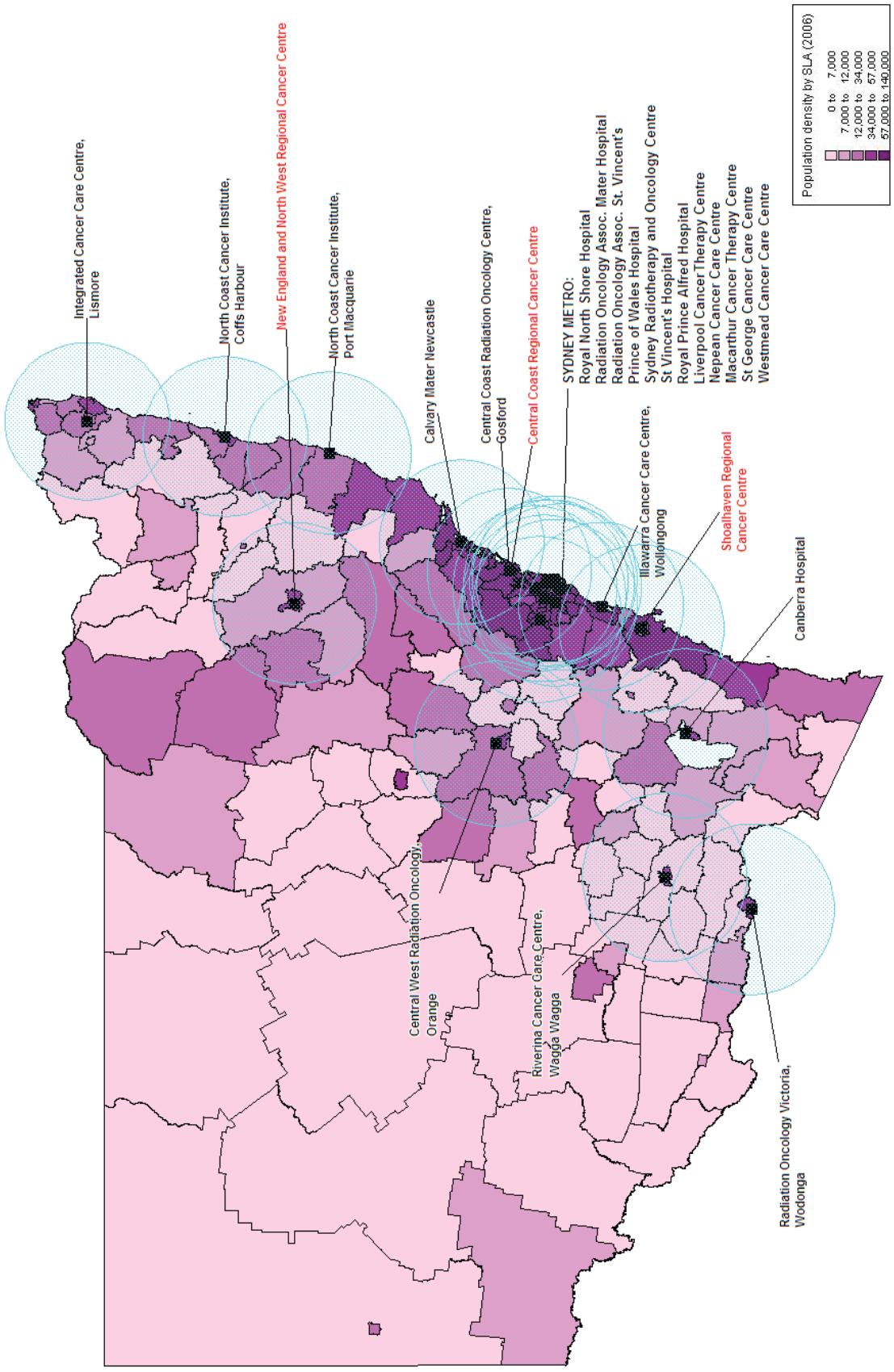
By 2016, when the integrated cancer care centres become operational in the Central West (Orange), Lismore, the Shoalhaven, and Tamworth, it is estimated that over 95% of the NSW population will reside within 100 kilometres of an ROTC. This includes public and private ROTCs in NSW, as well as the ACT. This is a significant achievement, but does highlight the need to also provide access strategies for those parts of the state that will not be able to sustain locally provided services.

The impact on travel and access is shown at Map 3.

The blue circles delineate a 100 kilometre radius from each ROTC. Shaded areas indicate population density by Statistical Local Areas, as per ABS 2006 Estimated Resident Population, using a Geographical Information System mapping software tool.

While it is acknowledged that there is always more which can be achieved in the planning and delivery of cancer services, and that extended travel for daily radiotherapy treatments can be onerous for patients and carers, it is noted that this position offers a continuing high level of access to radiotherapy services for NSW residents. It is also acknowledged that geographic proximity to a service is not the sole factor contributing to the use of radiotherapy as part of an overall treatment plan. NSW Health will continue to work with the CI NSW to identify and target these factors.

Map 3: >95% of NSW Residents within 100kms of an ROTC



Geographic areas of need to 2016

9

The number of machines required for 2016 has been determined based on projection of overall requirements for all residents and adjusted for patient flows. Planned expansions of treatment capacity to 2016, include the Central West service at Orange (one machine), Lismore (two machines), and Port Macquarie (one machine); and a fourth machine at Liverpool. These machines will be housed in the bunkers built as part of the original development for those centres.

Given that some NSW residents will be treated interstate, and there will also be interstate and overseas patients treated in NSW, there is an overall requirement of 67 linear accelerators for 2016.

For new or expanding services, consistent with the process of facility planning, more detailed implementation plans will need to be developed for individual ROTCs which reflect local population requirements; distribution of existing services; local health service priorities; and resource opportunities.

As a result of strategic planning of overall demand, and the distribution of this demand, a number of priority geographic areas for expansion to 2016 were identified. These included the New England, the Central Coast; the Illawarra / Shoalhaven, western Sydney; and the Hunter (as outlined in Appendix 3).

Detailed analysis of options for the specific locations, scope and cost of these radiotherapy services in the areas of geographic need is undertaken as part of the service and facility planning process. The timing of these analyses is determined by the annual budget cycle. These processes can have significant associated costs and need to be programmed accordingly.

9.1 Areas of Need funded under the Commonwealth Government's Health and Hospital Fund Regional Cancer Centre Initiative

In December 2009, the Commonwealth Government announced funding to establish new, or enhance existing regional cancer centres, via its Health and Hospitals Fund Regional Cancer Centre Initiative. Up to $560 million was announced as available. The NSW Government submitted applications for funding, consistent with the geographic areas of need. All NSW Government applications for funding were successful. In April 2010, the Commonwealth Government announced $113 million funding for the following projects.

The NSW Government is also contributing $35 million.

- The New England and North West Regional Cancer Centre will construct a new facility at Tamworth, with a two linear accelerator capacity and one linear accelerator commencing initially, provide patient / carer accommodation, as well as refurbishment and expansion of chemotherapy services at Armidale;

- The Central Coast Regional Cancer Centre project will construct a new facility at Gosford to deliver radiotherapy services. It will include two bunkers with two linear accelerators commissioned initially, refurbishment and expansion of the chemotherapy services, and refurbishment of the multidisciplinary clinic and day oncology unit at Wyong Hospital;

- Shoalhaven Regional Cancer Centre at Nowra will be a new facility providing radiotherapy services, chemotherapy treatment spaces, and patient and carer accommodation. It will be built with two bunkers and one linear accelerator;

- North Regional Cancer Care Centre project will expand and enhance services at the North Coast Cancer Institute, including installation of second linear accelerators at both Lismore and Port Macquarie, a Positron Emission Tomography (PET) scanner at Lismore, and a new Magnetic Resonance Imaging (MRI) unit at Coffs Harbour; and

- Illawarra Regional Cancer Centre at Wollongong will install a third linear accelerator and expand chemotherapy services.

9.1.1 Tamworth Area

Regarding the New England area, additional capacity equivalent to two machines is estimated to be required by 2016. Visiting specialists from Calvary Mater Newcastle provide one day a week Medical Oncology Service. Specialists from the Prince of Wales Hospital Sydney have provided a Radiation Oncology Outreach Service for many years, which is currently one day a week at Tamworth Rural Referral Hospital. A private provider (Radiation Oncology Associated Mater) also has provided a fortnightly outreach clinic, since 2001. New England residents also access radiotherapy services in Newcastle and Sydney as well as in Queensland.

It was considered that residents in the upper Hunter would seek radiotherapy treatment at Tamworth over Newcastle. Armidale residents would be likely to access Tamworth, but Tenterfield residents would more likely access Queensland or Lismore services.

The Tamworth Health Services Plan 2008 – 2012 (2008) recommends the development of an Integrated Cancer Care Service including the establishment of onsite radiotherapy services.

9.1.2 Central Coast

A capacity for an additional two linear accelerators to service this growing area is required by 2016. NSW Health commenced planning for the expansion of radiotherapy services on the Central Coast with the development of a Service Procurement Plan (SPP) and Project Definition Plan (PDP) that investigate and assess a range of possible options to meet future service requirements, including private sector provision.

9.1.3 Illawarra and Shoalhaven

Projected radiotherapy cases for the Illawarra / Shoalhaven area indicated the need for additional capacity equivalent to two linear accelerators to meet the requirements to 2016. Outreach services are provided at Nowra by the Illawarra Cancer Care Centre to enhance access to radiotherapy services. In addition, there is strong local community support for a linear accelerator for the Shoalhaven District Memorial Hospital at Nowra, and it has raised in the order of $900,000 as a contribution to service developments.

With the funding of the new centres at the Central Coast; Tamworth and Nowra; and, the funding of expanded capacity at Wollongong, Lismore and Port Macquarie, the remaining areas of needs are western Sydney and the Hunter.

9.2 Remaining Area of Need - Western Sydney

There is major growth (approximately 250,000 people) forecast to occur in Sydney's north west urban release area over the next 25 years. This population growth indicates a need for additional machines in this area.

The Commonwealth Government had advised that it had approved an application for Radiation Oncology HPG funds in late 2006 to a private provider for two machines to service Sydney's north-west. This service was anticipated to form part of the overall expansion of services required to service a growing population in the west and north west.

However, this approval is no longer in place. Western Sydney remains a priority for radiotherapy service provision. If all residents of the area were to be treated in the area, a capacity for three linear accelerators to service this growing area will be required by 2016.

The Area has identified the establishment of an integrated cancer centre at Blacktown Hospital as a future service development proposal, and this would be consistent with the enhancement of services in this geographic area.

9.3 Remaining Area of Need - Hunter

The Hunter New England Area Health Service was formed by the amalgamation of the former Hunter and New England Area Health Services plus Greater Taree, Great Lakes and Gloucester Local Government Areas from the former Mid North Coast Area Health Service.

Based on the assumptions and projected flows, the former Hunter Area Health Service requires additional capacity equivalent to two machines by 2016, either in the Greater Newcastle area or the lower Hunter, as well as additional capacity on the central coast (in relation to potential flows from the Lake Macquarie area).

The Commonwealth Government had approved a HPG application for a new private service, with capacity for two linear accelerators, in Newcastle. However, newspaper reports from November 2009 regarding the proposed private centre in Newcastle state that the provider has withdrawn from one location and is actively looking for another location in Newcastle. As at end May 2010, there have been no further public announcements of an alternate site in Newcastle.

The indicative requirement for the Hunter is two linear accelerators by 2016. The Calvary Mater Newcastle Hospital has five machines, and no room to expand on site.

10 Linear accelerator replacement program

Since 1995, 24 linear accelerators have been replaced in the public sector to the end of April 2010. These include three replacement machines in 2008 (one each at St George, Royal North Shore and Liverpool hospitals); three machines replaced in 2009 at Wollongong, Prince of Wales and Calvary Mater Newcastle hospitals; and, a further machine in 2010 at St George Hospital.

This has resulted in an average age of linear accelerators of 4.44 years in the public sector at the end of 2009. The number of replacement machines will increase to 27 in late 2010, when a machine each is replaced at the Liverpool, Nepean and Royal North Shore hospitals.

Timely replacement of linear accelerators is required to ensure cost effective treatment delivery. Funding sources include NSW Health, Area Health Services and the Commonwealth Government's HPGs. HPGs are grants paid by the Commonwealth Government directly to hospitals, based on patient throughputs, as a contribution towards equipment replacement. For linear accelerators under the HPG program, the notional treatment life, on average, is ten years, dependent on specific assessment of individual machines. It is noted that the Baume Report [49] recommended action to replace linear accelerators aged over 12 years.

10.1 Factors to be considered in replacement of linear accelerators

While 10 – 12 years is a generally accepted timeframe for machine replacement, other factors also need to be taken into account at the time when evaluating whether to replace a machine:

- level of breakdowns and ongoing maintenance issues – whether there is ongoing machine breakdown which disrupts patient treatment schedules;
- cost to repair machine including replacement parts, labour or maintenance contracts;
- ability to source, fund and replace machine parts for the existing machine;
- compatibility of the machine with other linear accelerators in the centre, in terms of being able to use existing patient planning data to enable transfer of patients between machines in the centre;
- assessment of the type of technology associated with the current machine and advantages of new technologies that a replacement machine might bring, for example, IMRT, IGRT, SRS;
- reliability of associated infrastructure such as cooling towers;
- increasing time required for quality assurance tasks because of the age of the machine;
- consideration as to whether the machine might be able to be retained for a further period so that it could deliver less complex treatment or be quarantined for palliative or emergency treatments, if bunker configuration will allow, and an additional machine purchased instead;
- review of patient flows to the centre and whether referrals are sufficient to justify a replacement machine at the time; whether referrals can be increased to justify replacement, taking into account any new centres that may have commenced treatment; and
- the timing of other replacement or expansion activity at ROTCs must take account of the level of disruption it may cause to service delivery over an extended period.

49 A Vision for radiotherapy: report of the Radiation Oncology Inquiry; [chair, Peter Baume] Canberra, Department of Health and Ageing, 2002.

Linear accelerator replacement program

On the basis that machines are optimally to be replaced at the age of 10 years, and including the above four replacement machines, 17 existing linear accelerators in the public sector will require replacement by 2016 (Appendix 1).

As part of Area Asset Management Plans, radiation oncology departments should complete forward asset replacement strategies. With the commencement of Radiation Oncology Machine Specific Funding in 2008, including payments specifically to enable networking of information systems, and provision for locally funded projects in the overall NSW capital program, Area Health Services should proactively plan for the routine replacement of this equipment.

Area Health Services will be required to plan for and fund replacement of their linear accelerators as part of Area Asset Strategic Plans. This will include depreciating the cost of the equipment at the appropriate rate. Work will be undertaken to develop a funding strategy to support the replacement of linear accelerators based a number of criteria as outlined above, including service need, productivity, life cycle costs, and state of repair.

Area Asset Strategic Plans are informed by the Area Healthcare Services Plans. In the case of radiotherapy equipment, these are also informed by this Strategic Plan. In these Plans, Areas identify a number of projects required to deliver health services in their Area, which are then prioritised and consolidated into the NSW Health Strategic Asset Management Plan.

11 Conclusion

This Plan provides the guidance required to determine the overall level of investment required to respond to the growth in demand expected for radiotherapy services. The development of the Plan has been accompanied by the development of a business case which, when funded through available resources, provides the template for the roll-out of additional services across NSW.

NSW identified, through its planning processes, areas of need for expansion. These are the Central Coast, western Sydney, Illawarra / Shoalhaven, and the Hunter New England. Significant funding from the Commonwealth Government via its Regional Cancer Centre initiative, combined with funds from the NSW State Government, are committed for public centres and linear accelerators on the Central Coast, Shoalhaven and Tamworth; as well as additional linear accelerators at Lismore and Port Macquarie. The Hunter and western Sydney remain areas of need.

Funded public centre expansions are occurring at Orange, Lismore and Liverpool hospitals and expansions have recently been completed at Coffs Harbour and Royal Prince Alfred Hospital. Additional capacity of six machines has been identified across three new private centres in Sydney.

The development of new services and expansion of existing services, in the public sector will take into account the growth in services provided by the private sector, and will be dependent on resource availability.

Although resource constraints are major issues, this does not preclude ongoing efforts to ensure that there is efficient use of services. The BPI project demonstrated that major improvements in efficiency could be achieved where there is consensus on the willingness to improve business processes.

By the end of the BPI project, throughput (the average increase in attendance per day, compared to baseline) had increased by more than 15%; waiting lists were reduced in most centres; the elapsed time from consultation to treatment was reduced in most centres; the treatment planning process at each centre was streamlined and simplified; and, the booking process in each centre has been formalised to maximise throughput.

The BPI tools that were developed during the project, and have been rolled out across all public centres, provide the capacity for sustaining these benefits and improving future local operational performance.

In addition, NSW has developed a range of strategies to sustain measurable improvements in total workforce numbers, vacancy rates, remuneration and clinical experience, across the three key professional groups.

The advice and support of the many clinicians involved in radiotherapy service delivery is acknowledged in the planning and effective delivery of this important treatment to residents of all of NSW.

NSW Health will continue to monitor, plan and appropriately invest in the provision of radiotherapy services as part of cancer care for the state.

Number of linear accelerators and proposed replacement linear accelerators by 2016

On the basis that machines are optimally to be replaced around the age of 10 years, dependent on individual assessment, following is a list of ROTCs and the number of machines to be replaced by 2016.

Public ROTC	Number of linear accelerators at end June 2010	Replacement machines (to 2016) in public ROTCs	Proposed replacement machines: Year(s) commenced operation
Calvary Mater Newcastle	5	2	2000, 2003
Royal North Shore	3	1	2004
St Vincent's	1	1	2005
St George	3	1	2006
Prince of Wales	3	1	2003
Illawarra (Wollongong)	2	1	2005
Macarthur (Campbelltown)	2	2	2003, 2005
Royal Prince Alfred	5	3	2004, 2005, 2006
Liverpool	3	1	2005
Nepean	2	1	2001[1]
Westmead	4	3	1996[2], 2004, 2005
North Coast Cancer Institute (Coffs Harbour, Port Macquarie, Lismore)	4	0	2007, 2010
Sub-Total	**37**	**17**	
Private ROTCs			
Central Coast Radiation Oncology - Gosford	2		
Sydney Radiation Oncology Centre (Wahroonga)	2		
St Vincent's Private Hospital	1		
Radiation Oncology Associates – Sydney Mater Misericordiae Hospital	2		
Riverina Cancer Care Centre – Calvary Hospital, Wagga Wagga	2		
Sub-Total	**9**		
Total	**46**		

Note:
In addition to the above table, four replacement machines are funded for: Calvary Mater Newcastle (1), Prince of Wales (1) and Illawarra (1) hospitals in 2008/09, and at St George Hospital (1) in 2009/10, Royal North Shore, Liverpool and Nepean hospitals in 2010. The Westmead (1996) replacement is on the Area's Locally Funded Initiatives Program for 2010/11.

(1) In June 2010, funding was approved for the replacement of the 2001 machine at the Nepean Cancer Care Centre.
(2) In May 2010, funding was approved for the replacement of the 1996 machine at the Westmead Cancer Care Centre.

Appendix 2

Planning of services – Role of new technologies

A number of existing processes are in place for health technology assessment in NSW. NSW Health works with other States, the Commonwealth and the Area Health Services (AHSs) in assessing new health technologies. Information obtained through these processes is shared between jurisdictions.

There are a number of recognised groups undertaking Health Technology Assessment (HTA), as well as rapid HTAs on new or emerging technologies. Information obtained through these processes is shared between jurisdictions.

The national jurisdictional Health Policy Advisory Committee for Technology (HealthPACT), which is an AHMAC subcommittee, shares national and international information on health technologies, including cost analysis and cost effectiveness data. HealthPACT is a sub-committee of the Clinical, Technical and Ethical Principal Committee (CTEPC). CTEPC is a principal committee of, and provides advice to, AHMAC. NSW is an active participant in HealthPACT deliberations and draws upon the expertise of HealthPACT when considering 'grey literature' as part of NSW HTA processes [50].

HealthPACT oversees a national horizon scanning process which is undertaken by the Australian and New Zealand Horizon Scanning Network. This process provides short, rapidly completed, 'state of play' documents, offering current information on technologies to alert planners and policy makers of the advent and potential impact in terms of safety and cost, before they are introduced into the health system. This proactive approach can then assist planners and policy makers to anticipate, control and monitor the introduction of new health technologies. Information provided by the horizon scanning process can present a trade off between the value of early, uncertain information, versus the value of certain, but late information which may be of limited relevance to decision makers due to the early diffusion of a technology.

The Medical Services Advisory Committee (MSAC) provides advice to the Australian Government regarding the safety, effectiveness and cost effectiveness of new technologies/ procedures. This information is used to inform decisions regarding public funding. The assessment process includes consideration of available evidence through medical literature reviews, in accordance with National Health and Medical Research Council guidelines.

New and emerging technologies / procedures which have limited evidence are not usually considered eligible for review by MSAC. Whilst MSAC can recommend interim funding to enable data collection in order to establish the evidence base, by this stage the uptake of many technologies / procedures by clinicians has already occurred. Whilst this partly reflects the rapid development and diffusion of new technologies, the MSAC process of review can often take over 12 months which is of concern for technologies likely to have significant health service or financial implications.

In addition, MSAC assessments do not address a number of issues which are of interest to state health policy and planners, including service planning and workforce requirements.

The Nationally Funded Centre (NFC) program provides for a small number of super specialty services for new and developing medical technologies and procedures on a national basis. The NFC Program is an AHMAC sub-committee. All States and Territory Governments contribute funding to the NFC Program. Prior to technologies being considered eligible for funding under the NFC Program, they are required to undergo a rigorous technology assessment to evaluate the long-term benefits and cost effectiveness of the procedure.

50 Grey literature is research that is either unpublished or has been published in a non-commercial form.

Appendix 2

The NFC Program is supported as an effective mechanism to control the introduction and unnecessary diffusion of high cost, highly complex and low volume procedures / technologies into Australia. It offers a method for the evaluation of a technology prior to broad diffusion. Once a technology has demonstrated its effectiveness and may have become more broadly available, it may be withdrawn from the NFC, and diffusion into the health system is then reliant upon support from the individual States.

Decisions regarding the procurement of new technologies need to be, and are, balanced by the evidence available; the requirement of the health system to provide contemporary clinical services; and, the funding available to provide health services, overall. NSW Health aims to ensure that the resource investment in high cost health technologies is maximised, with the service operating at optimal capacity and supported by an appropriate and sustainable workforce and clinical support services. This also needs to be considered in the context of ensuring equity of access for NSW residents.

Other issues such as local funding arrangements for health services, including the involvement of the private sector in health service delivery and service delivery models, will also significantly influence decisions regarding the potential investment and introduction of a specific technology in NSW Health.

Appendix 3

Additional linear accelerators by 2016

PUBLIC ROTCS (EXISTING SERVICES AND FUNDED EXPANSIONS)		
ROTCs	**Linear accelerators at June 2010**	**Approved Additional capacity by 2016**
Calvary Mater Newcastle	5	
Royal North Shore	3	
St Vincent's	1	
St George	3	
Prince of Wales	3	
Illawarra	2	1
Macarthur	2	
Royal Prince Alfred	5	
Liverpool	3	1
Nepean	2	
Westmead	4	
North Coast Cancer Institute – Coffs Harbour	2	
North Coast Cancer Institute – Port Macquarie	1	1
North Coast Cancer Institute – Lismore (New)	1	1
Central West (Orange) (New)		1
Shoalhaven (New)		1
Central Coast (New)		2
New England (Tamworth) (New)		1
Total additional machines		9
Sub-total (Public)	**37**	**46**

PRIVATE ROTCS (EXISTING SERVICES AND EXPANSIONS)		
ROTCs	**Linear accelerators at June 2010**	**Approved Additional capacity by 2016**
Central Coast Radiation Oncology Centre – Gosford	2	Not known for the private centres
Radiation Oncology Associates – St Vincent's Private – Darlinghurst	1	
Sydney Radiotherapy and Oncology Centre – Sydney Adventist Hospital – Wahroonga	2	
Radiation Oncology Associates – Sydney Mater Hospital – Crows Nest	2	
Riverina Cancer Care Centre – Wagga Wagga	2	
Kogarah (two private centres) - Expansion		4
Ryde (private – Macquarie University Hospital) - Expansion		2
Sub-total (Private)	9	6

ALL ROTCS		
Total Public machines by 2016	46	
Total Private machines by 2016		15
Total machines in place by 2016	61	

Example of demand for service scenario

This is an example of a demand scenario for an Area Health Service, distributed by ROTC / Hospital provider.

Referral AHS	ROTC	Actual 2008 % flows (as per RMIS)	Target % Flow 2016 Plan - Scenario One	Total Projected RT Cases 2016	Projected RT Cases to 2016 using targets	Projected Machine requirement 2016
AHS		**100.0%**	**100.0%**	**1672**	**1672**	**4.0**
	HOSPITAL A	70.4%	75.0%		1254	
	HOSPITAL B	6.9%	5.0%		84	
	HOSPITAL C	3.1%				
	HOSPITAL D	3.0%	4.0%		66	
	HOSPITAL E	4.4%	5.0%		84	
	HOSPITAL F	2.7%				
	HOSPITAL G	3.5%	5.0%		84	
	HOSPITAL H	2.6%	3.0%		50	
	HOSPITAL I	1.6%	1.5%		25	
	HOSPITAL J	0.9%	1.5%		25	
	OTHER	0.9%				

Appendix 5

Example of supply scenario for treating hospital / ROTC distributed by patient area of residence

ROTC	Referral AHS	Actual 2008 Patients accessing ROTCs	Target Flow to 2016	Actual number of machines at June 2010	Projected machine requirements 2016
Public ROTCs					
HOSPITAL A		**1411**	**1798**	**4**	**4.3**
	CCAHS	20	51		
	CSAHS	698	1254		
	FWAHS	11	0		
	GMAHS	4	0		
	HAHS	8	28		
	IAHS	19	20		
	MAHS	124	97		
	MNCAHS	16	0		
	MWAHS	34	34		
	NEAHS	6	0		
	NRAHS	11	0		
	NSAHS	100	81		
	SAHS	5	22		
	SESAHS	165	33		
	SWSAHS	86	125		
	WAHS	12	0		
	WSAHS	68	53		
	Interstate	6			
	Overseas	18			

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